20. JUBILEJNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH

17.–19. oktober 2012, Portorož, Slovenija

20th JUBILEE CONFERENCE ON MATERIALS AND TECHNOLOGY

17–19 October 2012, Portorož, Slovenia

PROGRAM IN KNJIGA POVZETKOV

PROGRAM AND BOOK OF ABSTRACTS

INŠTITUT ZA KOVINSKE MATERIALE IN TEHNOLOGIJE, LJUBLJANA

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20th JUBILEE CONFERENCE ON MATERIALS AND TECHNOLOGY

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VSEBINA – CONTENTS

Legenda – Legend:

NKM Napredni kovinski materiali, polimeri, keramika in kompozitni materiali – Synthesis of advanced metallic, polymeric, ceramic and composite materials
MS Modeliranje in simulacija procesov in tehnologij – Mathematical modeling and computer simulation of processes and technologies
TO Toplotna obdelava in vakuumska tehnika – Thermal treatment and Vacuum technique and technology
RN Razvoj naprednih proizvodnih tehnologij – Development of advanced manufacturing technologies
KD Korozija in degradacija materialov – Corrosion and degradation of materials
TP Tanke plasti in površine – Thin films and surfaces
NN Nanoznanost in nanotehnologije – Nanosciences and nanotechnologies
MF Materiali za fuzijo – Materials for fusion
VO Varstvo okolja – Environmental protection

VP Vabljena predavanja – Invited papers
GP Govorni prispevki – Oral
MR Mladi raziskovalci – Young scientists

20. JUBILEJNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH, 17. – 19. OKTOBER 2012
20TH JUBILEE CONFERENCE ON MATERIALS AND TECHNOLOGY, 17–19 OCTOBER, 2012

	WEDNESDAY, 17th October			THURSDAY, 18th October			FRIDAY, 19th October	
09:00	Opening ceremony Director IMT **Godec** Ministry of Education, Science, Culture and Sport – **Rončević**		09:00	Plenary lecture – **Schlesinger**		09:00	Plenary lecture – **Best**	
09:30	Plenary lecture – **Hogmark**							
			09:40	Invited lecture – **Gianfranceso**		09:40	Invited lecture – **Teichert**	
10:10	Plenary lecture – **Dubois**		10:00	Invited lecture – **Canale**		10:00	Invited lecture – **Leisch**	
			10:20	Podgornik	Tadić	10:20	Kokalj	Markoli
10:50	**Coffee Break**		10:35	Bajt Leban	Kevorkijan	10:35	Pavšič	Kastelic
11:10	Plenary lecture – **Koller**		10:50	Vallant	Terčelj	10:50	**Coffee Break**	
10:30			11:05	Lim H.	Ternik	11:10	Šetina Batič	Jenko M.
11:50	Invited lecture – **Bele**		11:20	**Coffee Break**		11:25	Mladenovič	Lichy
12:10	**12:10 – 13:45** **Lunch Break**		11:30	Medved	Veber	11:40	Beňo	Jenko D.
11:30			11:45	Sommitsch	Vukomanović	11:55	Kek Merl	Rodriguez Ripoll
13:45	Opening YR session – Godec		12:00	Gryc	Cagala	12:10	Elbel	Duchek
14:00	Poniku – Borković	Lorenzetti – Rozman	12:15	Socha	Huskić	12:25	Michalek	Upadhyay Kahaly
14:20	Bombač – Štrekelj	Arshad – Horvat	12:30	**12:30 – 14:00** **Lunch Break**		12:40	**Coffee Break**	
14:40	Harnuškova – Krajnc	Koruza – Zavašnik				13:00	Bednarova	Jirkova
15:00	Erturk – Soderžnik	Košir – Stanković	14:00	Plenary lecture – **Hansson**		13:15	Tikal	Kubina
15:20	Štadler – Zahradnik	Šegedin – Šmigovec				13:30	Avdiaj	Rosandić
15:40	Hočevar – Žužek	Drnovšek – Pukšič	14:40	Invited lecture – **Nolan**		13:45	Gliha	
16:00	Volšak – Kafexhiu	Astrouski – Dil	15:00	Kosmač			**Closing Ceremony**	
16:20	Česen – Sojer	Alanyali – Chabičovsky	15:15	Conradi				
16:40	**Coffee Break**		15:30	**Coffee Break**				
17:00	Adamkova – Bytyqi	Babič – Hauserova	15:45					
17:20	Abdi – Golozar	Unterreiter – Lašova	16:30	ARRS Top Achievements in RP (Materials) – Suvorov (in Slovene)				
17:40	Makarovič – Skalar	Ondrouškova – Mauder						
18:00	Štefanič – Korat	Bojinovič – Bernardin	17:00	**17:00–19:00** **Round Table Discussions** (in Slovene)				
18:20	Faruque – Ivekovič	Kodelja – Liu						
19:00	**Poster Session**							
20:00 – 21:30	**Cocktail Party**		20:00 – 22:00	**Gala dinner**				

PROGRAM 20. JUBILEJNE KONFERENCE O MATERIALIH IN TEHNOLOGIJAH
20th JUBILEE CONFERENCE ON MATERIALS AND TECHNOLOGY: PROGRAM

SREDA – WEDNESDAY 17. 10. 2012		
	Predsedujoči – Chair: Godec, Nolan	
9:00	**ODPRTJE – OPENING CEREMONY – Director IMT Godec** **Ministry of Education, Science, Culture and Sport – Rončević**	
9:30	Sture Hogmark The Ångström Laboratory, Uppsala University, Sweden CUTTING AND FORMING TOOL MATERIALS - PROPERTIES AND TRENDS IN THEIR DEVELOPMENT	
10:10	Jean-Marie Dubois Institut Jean Lamour (UMR 7198 CNRS - Université Lorraine), Ecole des Mines, Parc de Saurupt, F-54042 Nancy CONCEIVING A NEW METALLURGY WITH OLD ALLOYS	
10:50	**Odmor – Break**	
	Predsedujoči – Chair: Godec, Nolan	
11:10	Martin Koller,[1,2] Anna Salerno,[1] Alexander Muhr,[1] Angelika Reiterer,[1] Gerhart Braunegg[2] [1]Graz University of Technology, Institute of Biotechnology and Biochemical Engineering, Petersgasse 12, 8010 Graz, Austria [2]ARENA - Association for resource efficient and sustainable technologies; Inffeldgasse 23, 8010 Graz, Austria POLYHYDROXYALKANOATES: BIODEGRADABLE POLYMERIC MATERIALS FROM RENEWABLE RESOURCES	
11:50	Marjan Bele[1,2], Nejc Hodnik[1], Milena Zorko[1], Aleksander Rečnik[3], Nataša Zabukovec Logar[1], Stanko Hočevar[1,2,3], Miran Gaberšček[1,2] [1]National Institute of Chemistry, Ljubljana, Slovenia; [2]Centre of Excellence for Low-Carbon Technologies, Ljubljana, Slovenia; [3]Jozef Stefan Institute, Ljubljana, Slovenia; [4]Mebius d.o.o., Ljubljana, Slovenia STRUCTURAL ORDERING OF ALLOYED Pt-Cu NANOPARTICLES AFFECTS DECISIVELY THEIR ELECTROCATALYTIC ACTIVITY AND STABILITY	
12:10 – 13:45 ODMOR ZA KOSILO – LUNCH BREAK		
13:45	**Openning Young Researchers Session – Stane Pejovnik**	
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14:00	Besnik Poniku, Igor Belič, Monika Jenko Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia USING LINESHAPE ANALYSIS AND FOURIER TRANSFORM TO IMPROVE THE INTERPRETATION OF AUGER SPECTRA	
14:10	Predrag Borković, Borivoj Šuštaršič, Borut Žužek, Vojteh Leskovšek Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia DETERMINATION OF SN CURVES OF SPRING STEEL MATERIAL AS A FAST AND RELIABLE METHOD USING A HIGH-FREQUENCY PULSATOR CRACKTRONIC	
14:20	David Bombač, Goran Kugler SPACE-SI, Slovenian Centre of Excellence for Space Sciences and Technologies, Askerceva 12, 1000 Ljubljana, Slovenia, Department of Materials and Metallurgy, Facults of Natural Sciences and Engineering, University of Ljubljana, Askerceva 12, 1000 Ljubljana, Slovenia INFLUENCE OF ASYMMETRY IN kMC SIMULATIONS OF PRECIPITATION IN ALLOYS	

14:30	Neva Štrekelj[1], Iztok Naglič[1], Blaž Karpe[1], Borut Kosec[1], Tonica Bončina[2], Franc Zupanič[2], Boštjan Markoli[1] [1]Faculty of Natural Sciences and Engineering, University of Ljubljana, Aškerčeva 12, Slovenia, [2]Faculty of Mechanical Engineering, University of Maribor, Smetanova 17, Slovenia SYNTHESIS OF Al-BASED ALLOY WITH QUASICRYSTALS	
14:40	Jana Harnúšková IMMM SAS, Račianska 75, SK-831 02 Bratislava FOAMS OF HEAT TREATABLE ALUMINIUM ALLOYS	
14:50	Miha Kovačič[1], Beno Jurjovec[2], Luka Krajnc[2] [1]ŠTORE STEEL d.o.o., Železarska cesta 3, SI-3220 Štore, Laboratory for Multiphase Processes, University of Nova Gorica, Vipavska 13, SI-5000, Slovenia, [2]ŠTORE STEEL d.o.o., Železarska cesta 3, SI-3220 Štore, Slovenia MODEL OF LADLE NOZZLE OPENING BASED ON GENETIC PROGRAMMING	
15:00	Alpay Tamer Erturk, Tulin Sahin Mechanical Eng. Dept., University of Kocaeli, Izmit, Turkey FOAMING CHARACTERISTICS CONTROL VIA TUBULAR DIE LENGTH OF ALUMINUM FOAM	
15:10	Marko Soderžnik[1], Paul McGuiness[1,2], Spomenka Kobe[1] [1]Jožef Stefan Institute, Jamova 39, Ljubljana, Slovenia, [2]Centre of Excellence NAMASTE, Jamova 39, Ljubljana, Slovenia MICROSTRUCTURAL ENGINEERING OF Nd-Fe-B MAGNETS	
15:20	Bohuslav Mašek, Ctibor Štádler, Hana Jirkova, Peter Feuser, Mike Selig Research Centre of Forming Technology – FORTECH, University of West Bohemia, Univerzitní 22, CZ-306 14 Pilsen, Czech Republic, Daimler AG, Mercedes Cars Entwicklung, Umformtechnik und Rapid Tooling, Bela-Barenyi-Str., D-71063 Sindelfingen, AutoForm Development GmbH, Technoparkstrasse 1, 8005 Zürich, Switzerland TRANSFORMATION-INDUCED PLASTICITY IN STEEL FOR HOT STAMPING	
15:30	Radek Zahradník, Josef Hrabovský, Miroslav Raudenský Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic INFLUENCE OF THE ROLLING LOADS ON THE STRESS IN THE ROLL SURFACE LAYER	
15:40	Matej Hočevar[1], Matjaž Godec[1], Monika Jenko[1], Damjana Drobne[2], Sara Novak[2] [1]Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia, [2]Department of Biology, Biotechnical Faculty, University of Ljubljana, Večna pot 111, SI-1000 Ljubljana, Slovenia ADHESION OF ESCHERICHIA COLI TO AUSTENITIC STAINLESS STEEL (AISI 316L) WITH DIFFERENT SURFACE FINISHES	
15:50	Borut Žužek, Franc Vodopivec, Bojan Podgornik, Monika Jenko, Matjaž Godec Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia CALCULATION OF ACTIVATION ENERGY FOR CREEP DEFORMATION OF STEEL WITH UNIFORM CARBIDE PARTICLES DISTRIBUTION	
16:00	Darja Volšak[1], Maja Vončina[2], Primož Mrvar[2], Jožef Medved[2] [1]IMPOL d.o.o., Partizanska 38, 2310 Slovenska Bistrica, Slovenia, [2]University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Materials and Metallurgy, Aškerčeva 12, 1000 Ljubljana, Slovenia THERMAL ANALYSIS OF AlCu5.5 ALLOY WITH Nd	
16:10	Fevzi Kafexhiu, Franc Vodopivec, Jelena Vojvodič Tuma Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia DEPENDENCE OF CREEP RATE ON MICROSTRUCTURAL CHANGES IN WELDS OF MARTENSITIC 9-12% Cr STEELS	

16:20	Aleš Česen, Andraž Legat Slovenian National Building and Civil Engineering Institute, Dimičeva 12, 1000 Ljubljana, Slovenia MONITORING OF CORROSION PROCESSES OF STEEL IN CONCRETE IN CHLORIDE ENVIRONMENT	
16:30	D. Sojer, P. J. McGuiness, I. Škulj IJS, Jamova cesta 39, 1000 Ljubljana, Slovenija PROTECTION OF $Nd_2Fe_{14}B$ MELT SPUN RIBBONS BY SOL GEL DERIVED FILMS OF SiO_2 AND Al_2O_3	
16:40	**ODMOR – BREAK**	
	Predsedujoči – Chair: Jenko, Kobe, Hogmark, Leisch, Podgornik	
17:00	Petr Jelínek, František Mikšovský, Jaroslav Beňo, Eliška Adámková Department of Metallurgy and Foundry Engineering, FMMI, VŠB – Technical University of Ostrava, 17. Listopadu 15/2172, Ostrava – Poruba, Czech Republic DEVELOPMENT OF FOUNDRY CORES BASED ON INORGANIC SALTS	
17:10	Arsim Bytyqi[1], Igor Belič[2], Monika Jenko[2] [1]Štore Steel Company d.o.o. železarska cesta 3, Slovenia, [2]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia MODELLING OF GRAIN SIZE DISTRIBUTION IN SPRING STEEL MICROSTRUCTURE	
17:20	Somayeh Abdi Leibniz-Institut für Festkörper- und Werstoffforschung Dresden, Helmholtzstr. 20, 01069, Dresden, Germany GLASS-FORMING $Ti_{75}Zr_{10}Si_{15}$-BASED ALLOYS FOR IMPLANT APPLICATIONS	
17:30	M. Golozar[1], R. A. Brooks[2], A. L. Greer[3], R. E. Cameron[1], S. M. Best[1] [1]Cambridge Centre for Medical Materials, Dept. of Materials Science and Metallurgy, University of Cambridge, Cambridge, Pembroke Street, UK, [2]Orthopedic Research Unit, Addenbrooke's Hospital, University of Cambridge, Cambridge, UK, [3]Microstructural Kinetics Group, Dept. of Materials Science and Metallurgy, University of Cambridge, Cambridge, Pembroke Street, UK PEO COATINGS ON TI-BASED ALLOYS FOR MEDICAL APPLICATIONS: PRODUCTION AND CHARACTERIZATION	
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17:50	Tina Skalar, Marjan Marinšek, Amalija Golobič, Jadran Maček University of Ljubljana, Faculty of Chemistry and Chemical Technology, Aškerčeva 5, Ljubljana, Slovenia PREPARATION AND ANALYSIS OF Ni-SDC MATERIAL FOR SOFC APPLICATION	
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18:10	Lidija Korat[1], Breda Mirtič[2], Andraž Legat[1] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, SI-1000 Ljubljana, [2]Univeristy of Ljubljana, Faculty of Natural Sciences and Engineering, Department of geology, Aškerčeva 12, SI-1000 Ljubljana BIOMASS ASH CHARACTERIZATION AND ITS USE IN CEMENT-BASED MATERIALS	

18:20	M. R. I. Faruque[1,2], M. T. Islam[1] [1]Institute of Space Science (ANGKASA), [2]Dept. of Electrical, Electronic and Systems Engineering, Faculty of Engineering and Built Environment, Universiti Kebangsaan Malaysia, 43600 UKM, Bangi, Selangor, Malaysia ANALYSIS OF METAMATERIALS ON RADIO FREQUENCY ELECTROMAGNETIC FIELDS IN HUMAN HEAD AND HAND	
18:30	Aljaž Iveković, Saša Novak Department for nanostructured materials, Jožef Stefan Institute, Ljubljana, Slovenia, Slovenian Fusion Association EURATOM-MHEST, Ljubljana, Slovenia, Jožef Stefan International Postgraduate School, Ljubljana, Slovenia FABRICATION OF SiC_f/SiC COMPOSITES BY SITE-P PROCESS	
19:00	**Poster Session**	
20:00	**Cocktail Party**	

13:45	**Openning Young Researchers Session – M. Godec**	
	Dvorana 2	
	Predsedujoči – Chair: Nolan, Suvorov, Žigon, Šarler, Torkar	
14:00	Martina Lorenzetti[1,2], Saša Novak[1,2], Spomenka Kobe[1,2] [1]Department for Nanostructured Materials, Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Jamova cesta 39, 1000 Ljubljana, Slovenia INVESTIGATION OF THE PROPERTIES OF TITANIA COATINGS ON Ti-BASED ALLOYS SUBSTRATES FOR BODY IMPLANTS	
14:10	Nejc Rozman[1], Luka Škrlep[1], Miran Gaberšček[2], Tina Marolt[3], Petra Živec[3], Andrijana Sever Škapin[1] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, Ljubljana, Slovenia, [2]National Institute of Chemistry, Hajdrihova 19, Ljubljana, Slovenia, [3]TRC JUB d.o.o., Dol pri Ljubljani 28, 1262 Dol pri Ljubljani, Slovenia THE INFLUENCE OF SELECTED SYNTHESIS PARAMETERS ON THE STRUCTURAL AND FUNCTIONAL PROPERTIES OF NANOCRYSTALLINE TITANIA	
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14:40	Jurij Koruza, Barbara Malič, Oleksandr Noshchenko, Marija Kosec Electronic Ceramics Department, Jožef Stefan Institute, Jamova cesta 39, Ljubljana, Slovenia A TOP-DOWN APPROACH FOR PREPARATION OF SODIUM NIOBATE NANOPOWDERS	
14:50	Janez Zavašnik, Matic Šobak, Matejka Podlogar, Aleksander Rečnik Institut Jožef Stefan, Jamova 39, SI-1000 Ljubljana IRON SULPHIDES SYNTHESIZED BY CHEMICAL VAPOUR METHOD	
15:00	Mateja Košir[1], Nina Daneu[1,2], Aleksander Rečnik[1,2], Slavko Bernik[1,2] [1]Jožef Stefan Institute, Department for Nanostructured Materials, Jamova cesta 39, 1000 Ljubljana, Slovenia, [2]Center of Excellence NAMASTE, Jamova cesta 39, 1000 Ljubljana, Slovenia MICROSTRUCTURAL AND STRUCTURAL STUDIES OF THE $(ZnO)_x$ In_2O_3 SYSTEM FOR THERMOELECTRIC APPLICATIONS	

15:10	Nadežda Stanković, Nina Daneu, Aleksander Rečnik Department for Nanostructured Materials, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia TRANSFORMATION OF ILMENITE TO RUTILE AND HEMATITE PSEUDOMORPHS FROM MWINILUNGA (ZAMBIA)	
15:20	Urban Šegedin, Klemen Burja*, Franci Malin, Saša Skale, Bogdan Znoj, Peter Venturini Central Development of Helios Group, Helios Domžale d.d., Količevo 2, 1230 Domžale, Slovenija, *Centre of Excellence PoliMaT, Tehnološki park 24, 1000 Ljubljana, Slovenija STYRENE ACRYLIC COPOLYMER SYNTHESIS IN HIGH PRESSURE REACTOR	
15:30	Tina Šmigovec Ljubič, Majda Žigon, Ema Žagar Laboratory for Polymer Chemistry and Technology, National Institute of Chemistry, Hajdrihova 19, SI-1000, Ljubljana, Slovenia CHARACTERIZATION OF POLY(STYRENE-*b*-ISOPRENE) MIKTOARM STAR COPOLYMERS OF THE PS(PI)$_x$ TYPE BY DIFFERENT CHROMATOGRAPHIC TECHNIQUES	
15:40	Nataša Drnovšek[1], Katja Rade[1], Miran Čeh[1], Dorothée Pierron[2], Marie-Francoise Harmand[2], Marko Gradišar[3], Urška Dragin[4], Rok Romih[4], Saša Novak[1] [1]Department for Nanostructured Materials, Jožef Stefan Institut, Jamova cesta 39, 1000 Ljubljana, Slovenia, [2]Laboratoire d'Evaluation des Matériaux Implantables (LEMI), Technopole Bordeaux-Montesquieu, France, [3]Helipro d.o.o., 4248 Lesce, Slovenia, [4]Institute of Cell Biology, Faculty of Medicine, University of Ljubljana, Slovenia BIOACTIVE ANATASE COATING ON Ti-ALLOY IMPLANTS	
15:50	Nuša Pukšič, Monika Jenko Institute of Metals and Technology, Lepi pot 11, Ljubljana, Slovenia THE INFLUENCE OF OUTSIDE STRAIN ON THE ATOMIC RELAXATIONS AND VIBRATIONS ON STEPPED Cu AND Ni SURFACES	
16:00	Ilya Astrouski, Miroslav Raudenský Heat Transfer and Fluid Flow Laboratory, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic EXPERIMENTAL STUDIES OF THE POLYMERIC HOLLOW FIBER HEAT EXCHANGERS	
16:10	Gökçe Dil[1], Ali Göksenli[1], Behiye Yüksel[2], Cagdas Calli[3] [1]TU Istanbul, Mechanical Engineering Department, 34437 Istanbul, [2]TUBITAK, MAM Material Research Institute, Gebze, Kocaeli, [3]TU Istanbul, Mechanical Metallurgical and Materials Engineering Department, 34469 Maslak, Istanbul ELECTROLESS Ni-B-W COATINGS FOR IMPROVING HARDNESS, WEAR AND CORROSION RESISTANCE	
16:20	Ekrem Altuncu, Hasan Alanyalı Kocaeli University, Hereke Borusan Campus, Vocational School of Asim Kocabiyik, 41800 Kocaeli/ Turkey APPLICIABILITY OF THIN CERAMIC COATINGS FOR MAGNESIUM ALLOYS BY SOL-GEL METHOD	
16:30	Martin Chabičovský, Miroslav Raudenský Heat Transfer and Fluid Flow Laboratory, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic EXPERIMENTAL INVESTIGATION OF THE HEAT TREATMENT IN CONTINUOUS LINES	
16:40	**ODMOR – BREAK**	
	Predsedujoči – Chair: Nolan, Suvorov, Žigon, Šarler, Torkar	
17:00	Matej Babič[1], Matjaž Milfelner[2], Peter Kokol[3], Igor Belič[4], Jerneja Babič [1]Emo-Orodjarna d.o.o., [2]Tic-lens d.o.o., [3]Univerza v Mariboru, Fakulteta za zdravstvene vede USE FRACTAL GEOMETRY TO DESCRIBE POROSITY OF ROBOT LASER HARDENED SPECIMENS WITH OVERLAP	

17:10	Daniela Hauserova, Jaromír Dlouhy, Zbysek Novy, Jozef Zrnik COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic ACCELERATED CARBIDE SPHEROIDISATION AND REFINEMENT (ASR) OF C45 STEEL DURING INDUCTION HEATING	
17:20	Guenter Unterreiter[1], Andreas Ludwig[2], Menghuai Wu[2], Alexander Vakhrushe[2], Anton Ishmurzin[1] [1]Materials Center Leoben Forschung GmbH, Roseggerstrasse 12, 8700 Leoben, Austria, [2]Chair for Simulation and Modelling of Metallurgical Processes, Franz-Josef-Strasse 18, University of Leoben, Austria SIMULATION OF THE CASTING AND QUENCHING PROCESS OF A LABORATORY AlSi7MgCu05 CASTING	
17:30	Zuzana Lašová, Robert Zemčík, Jan Bartošek University of West Bohemia, Univerzitní 8, Plzeň 306 14, Czech Republic COMPUTATIONAL MODEL OF SANDWICH BEAM WITH PIEZOELECTRIC PATCHES	
17:40	Jana Ondroušková[1], Michal Pohanka[1], Bart Vervaet[2] [1]Heat Transfer and Fluid Flow Laboratory, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic, [2]Centre for Research in Metallurgy, Technologiepark 9, B-9052 Zwijnaarde, Belgium HEAT FLUX COMPUTATION FROM MEASURED TEMPERATURE HISTORIES DURING HOT ROLLING	
17:50	Tomas Mauder, Pavel Charvat, Milan Ostry Brno University of Technology, Faculty Mechanical Engineering, Technicka 2, Brno, Czech Republic EXPERIMENTAL AND NUMERICAL INVESTIGATION OF AN AIR-PCM HEAT EXCHANGER	
18:00	Marko Bojinović, Matjaž Milfelner, Zoran Lestan TIC-Lens laserske tehnologije d.o.o, Bežigrajska cesta 10, 3000 Celje, Slovenija NUMERICAL MODELING AND EXPERIMENTAL RESULTS OF LASER SURFACE HARDENING	
18:10	Petr Bernardin, Josef Vacík, Tomáš Kroupa, Radek Kottner University of West Bohemia, Univerzitní 8, 306 14 Pilsen, Czech Republic DETERMINATION OF MECHANICAL PARAMETERS OF BONDED JOINT BETWEEN METAL AND COMPOSITE BY COMPARING EXPERIMENTS WITH FINITE ELEMENT MODELS	
18:20	Tadej Kodelja[1], Igor Grešovnik[1,2], Robert Vertnik[2,4], Božidar Šarler[1,2,3] [1]Center of Excellence BIK, Solkan, Slovenia, [2]Laboratory for Multiphase Processes, University of Nova Gorica, Nova Gorica, Slovenia, [3]IMT, Ljubljana, Slovenia, [4]Štore-Steel Technical Development, Štore, Slovenia TOPMOST STEEL PRODUCTION DESIGN BY USING ARTIFICIAL NEURAL NETWORK THROUGH PROCESS MODELING	
18:30	Qingguo Liu[1], Božidar Šarler[1,2,3] [1]University of Nova Gorica, Nova Gorica, Slovenia, [2]IMT, Ljubljana, Slovenia, [3]Center of Excellence BIK, Solkan, Slovenia A NON-SINGULAR METHOD OF FUNDAMENTAL SOLUTIONS AND ITS APPLICATION TO TWO DIMENSIONAL MULTI-BODY ELASTICITY PROBLEMS	
19:00	**Poster Session**	
20:00	**Cocktail Party**	

ČETRTEK – THURSDAY 18. 10. 2012		
	Predsedujoči – Chair: Godec, Hogmark	
9:00	Mark E. Schlesinger Department of Materials Science and Engineering, Missouri University of Science and Technology THE MYSTERY OF THE MISSING CANS: UBC RECYCLING IN THE UNITED STATES	
9:40	A. Di Gianfrancesco, S. Tiberi Vipraio, D. Venditti Centro Sviluppo Materiali S.p.A., Via di Castel Romano 100, Rome, 00128, Italy LONG TERM MICROSTRUCTURAL EVOLUTION OF 9–12 %Cr STEEL GRADES FOR STEAM POWER GENERATION PLANTS	
10:00	Lauralice Canale[1], Nikolai Kobasco[2], George E. Totten[3] [1]Universidade de São Paulo, São Carlos, Brazil, [2]IQ Technologies Inc., Akron, OH USA, [3]Portland State University, Portland, OR, USA INTENSIVE QUENCHING AND APPLICATION FOR PARTS PRODUCTION	
	Dvorana 1	
	Predsedujoči – Chair: Godec, Hogmark	
10:20	Bojan Podgornik, Vojteh Leskovšek Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia DETERMINING DIVERSE TOOL AND HIGH-SPEED STEEL PROPERTIES USING A SINGLE K_{ic}-TEST SPECIMEN	
10:35	J. Kovač, A. Legat, M. Bajt Leban Slovenian National Building and Civil Engineering Institute (ZAG), Dimičeva 12, 1000 Ljubljana MONITORING OF SCC OF STAINLESS STEEL UNDER INCREASED TEMPERATURES AND PRESSURES	
10:50	Kl. Kerschbaumer[1], R. Vallant[1], N. Enzinger[1], C. Sommitsch[1] [1]Institute for Materials Science and Welding, Kopernikusgasse 24, A-8010 Graz, Austria CORROSION AND MECHANICAL PROPERTIES OF WELDED ALUMINIUM AND MAGNESIUM ALLOYS FOR REFRIGERATION COMPRESSORS IN COMPARISON WITH DEEP-DRAWING STEEL	
11:05	Hwee Ling Lim, Lyas Al Tayeb, Ait Tayeb, Mohamed Abdulrahman Othman The Petroleum Institute, P.O.Box 2533, Sas Al Nakheel Campus, Abu Dhabi, U.A.E. ASSESSING QUALITY OF CORROSION EDUCATION IN THE UNITED ARAB EMIRATES	
11:20	**ODMOR – BREAK**	
	Predsedujoči – Chair: Gianfrancesco, Šolić	
11:30	Jožef Medved[1], Primož Mrvar[1], Darja Steiner-Petrovič[2], Grega Klančnik[1] [1]University of Ljubljana, Faculty of Natural Sciences and Engineering, Department for Materials and Metallurgy, Aškerčeva 12, Ljubljana, Slovenia, [2]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia THERMODYNAMIC OPTIMIZATION OF HIGH ALLOYED STEELS	
11:45	Cornelia Pein, Bernhard Sonderegger, Christof Sommitsch Institute for Materials Science and Welding, Graz University of Technology, Austria INTERACTIONS OF GRAIN BOUNDARY TRIPLE POINTS, PRECIPITATES AND PORES WITHIN A HETEROGENEOUS MICROSTRUCTURE AND THEIR INFLUENCE ON INTERNAL STRESS AND STRAIN DISTRIBUTIONS	

12:00	Karel Gryc[1], Bedřich Smetana[2], Monika Žaludová[2], Karel Michalek[1], Petr Klus[1], Markéta Tkadlečková[1], Ladislav Socha[1], Jana Dobrovská[2], Pavel Machovčák[3], Ladislav Válek[4], Radim Pachlopnik[4], Bohuslav Chmiel[5] [1]VŠB-Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of Metallurgy and Foundry, and Regional Materials Science and Technology Centre, 17. listopadu 15, 708 33 Ostrava-Poruba, Czech Republic, [2]VŠB-Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, Department of Physical Chemistry and Theory of Technological Processes, nad Regional Materials Science and Technology Centre, 17. listopadu 15, 708 33 Ostrava-Poruba, Czech Republic, [3]VÍTKOVICE HEAVY MACHINERY a. s., Ruská 2887/101, 706 02 Ostrava-Vítkovice, Czech Republic, [4]ArcelorMittal Ostrava a.s., Research, Vratimovská 689, 707 02 Ostrava-Kunčice, Czech Republic, [5]TŘINECKÉ ŽELEZÁRNY a.s., Průmyslová 1000, 73970 Třinec-Staré Město, Czech Republic DETERMINATION OF SOLIDUS AND LIQUIDUS TEMPERATURES OF THE REAL STEEL GRADES BY DYNAMIC THERMAL ANALYSIS METHODS	
12:15	Ladislav Socha[1], Jiří Bažan[1], Jan Morávka[2], Petr Styrnal[3], Václav Pilka[4], Zbygněv Piegza[4] [1]VŠB – Technical University of Ostrava, FMME, Department of Metallurgy and Foundry, 17. listopadu 15/2172, 708 33 Ostrava – Poruba, Czech Republic, [2]MATERIÁLOVÝ A METALURGICKÝ VÝZKUM, s.r.o., Pohraniční 693/31,706 02 Ostrava, Czech Republic, [3]JAP TRADING, s.r.o., Karpentná 146, 739 94 Třinec, Czech Republic, [4]TŘINECKÉ ŽELEZÁRNY, a.s., Průmyslová 1000, 739 70 Třinec – Staré Město, Czech Republic OPTIMALISATION OF SLAG MODE IN THE LADLE DURING STEEL PROCESSING AT SECONDARY METALLURGY	
12:30 – 14:00 ODMOR ZA KOSILO – LUNCH BREAK		

	Dvorana 2	
	Predsedujoči – Chair: Hansson, Leskovšek	
10:20	Aleksandar Sedmak[1], Radica Prokić-Cvetković[1], Srdjan Tadić[2] [1]Faculty of Mechanical Engineering, Belgrade, Kraljice Marije 16, Serbia, [2]Innovation Center, Faculty of Mechanical Engineering, Belgrade, Kraljice Marije 16, Serbia SUPERPLASTIC DEFORMATION OF X7093 Al ALLOY	
10:35	Varužan Kevorkijan Impol R in R d.o.o., Partizanska 38, 2310 Slovenska Bistrica, Slovenia CHALLENGES AND ADVANTAGES OF RECYCLING WROUGHT ALUMINIUM ALLOYS FROM LOWER GRADES OF METALLURGICAL CLEAN SCRAP	
10:50	M. Terčelj, M. Fazarinc, G. Kugler, P. Cvahte, D. Bombač, I. Perus Faculty of Natural Science and Engineering, University of Ljubljana, Aškerčeva cesta 12, 1000 Ljubljana, Slovenia IMPROVEMENT IN MECHANICAL PROPERTIES OF AN EXTRUDED AA6082 BY OPTIMIZING OF CHEMICAL COMPOSITION AND PROCESS PARAMETERS	
11:05	Primož Ternik[1], Rebeka Rudolf[2,3], Zoran Žunič[4] [1]Private Researcher, Bresterniška ulica 163, 2354 Bresternica, Slovenia, [2]University of Maribor, Faculty of Mechanical Engineering, Smetanova 17, 2000 Maribor, Slovenia, [3]Zlatarna Celje d.d., Kersnikova ul.19, 3000 Celje, Slovenia, [4]AVL-AST, Trg Leona Štuklja 5, 2000 Maribor, Slovenia NUMERICAL STUDY OF RAYLEIGH-BÉNARD NATURAL CONVECTION HEAT TRANSFER CHARACTERISTICS OF WATER BASED Au NANOFLUID	
11:20	**ODMOR – BREAK**	
	Predsedujoči – Chair: Hansson, Leskovšek	
11:30	Asja Veber, Špela Kunej, Danilo Suvorov Jozef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia INFLUENCE OF THE ELECTRODE GEOMETRY OF A Co-PLANAR CAPACITOR ON THE ACCURACY OF THE MEASURED MW DIELECTRIC PROPERTIES OF $Na_{0.5}Bi_{0.5}TiO_3$-$NaTaO_3$ THIN FILMS	

11:45	Marija Vukomanović, Vojka Žunič, Mojca Otoničar, Srečo Davor Škapin, Danilo Suvorov Advanced Materials Department, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, Slovenia HYDROXYAPATITE AS BIO-SOURCED SEMICONDUCTOR APPLICABLE FOR SELF-CLEANING	
12:00	Michal Cagala, Petr Lichý, Marek Břuska Department of Metallurgy and Foundry Engineering, FMMI, VŠB – Technical University of Ostrava, 17.Listopadu 15/2172, Ostrava – Poruba, Czech Republic INFLUENCE OF ALUMINIUM ALLOYS RE-MELTING ON THE STRUCTURE AND MECHANICAL PROPERTIES	
12:15	Miroslav Huskić, Alojz Anžlovar, Majda Žigon Co PoliMat, Tehnološki park 24, Ljubljana Slovenia, Kemijski inštitut, Hajdrihova 19, Ljubljana Slovenia NANOCOMPOSITES OF PHENOLIC RESIN/MONTMORILLONITE PREPARED BY ONE STEP IN SITU INTERCALATIVE POLYMERIZATION	
12:30 – 14:00 ODMOR ZA KOSILO – LUNCH BREAK		
	Predsedujoči – Chair: Podgornik, Conradi	
14:00	Per Hansson SSAB, Oxelösund, Sweden MANUFACTURING OF PRE-HARDENED VERY CLEAN TOOL STEEL	
14:40	David Nolan Principal Research Scientist, Bluescope Steel Ltd STRATEGIES FOR SUCCESSFUL COLLABORATIVE RESEARCH BETWEEN ACADEMIA AND MANUFACTURING INDUSTRIES	
15:00	Alenka Kosmač Euro Inox - European Stainless Steel Association, Brussels, Belgium STAINLESS STEELS: WHAT NEW MARKETS CAN BE DEVELOPED IN THE YEARS AHEAD?	
15:15	Marjetka Conradi[1], Aleksandra Kocijan[1], Milena Zorko[2], Ivan Jerman[2,3] [1]Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]National Institute of Chemistry, Hajdrihova 19, 1000 Ljubljana, Slovenia, [3]CO-NOT, Hajdrihova 19, Ljubljana, Slovenia EFFECT OF SILICA/PVC COMPOSITE COATINGS ON STEEL-SUBSTRATE CORROSION PROTECTION	
15:30	ODMOR – BREAK	
16:30	**ARRS Top Achievements in RP (Materials) – Suvorov (in Slovene)**	
17:00 – 19:00	**Round table discussions (in Slovene)**	
20:00 – 22:30	**Gala dinner**	

PETEK – FRIDAY 19. 10. 2012		
	Predsedujoči – Chair: Jenko, Kobe	
9:00	Serena Best Department of Materials Science and Metallurgy, University of Cambridge BIOCERAMICS FOR SKELETAL REPAIR	
9:40	Christian Teichert Institute of Physics, Montanuniversität Leoben, Franz Josef Str. 18, A-8700 Leoben, Austria GRAPHENE AS SUBSTRATE FOR ORGANIC THIN FILMS	
10:00	M. Leisch Institute of Solid State Physics, Graz University of Technology, A 8010 Graz, Austria ATOMIC LEVEL CHARACTERIZATION OF VACUUM ANNEALED STAINLESS STEELS	
10:20	Tadej Kokalj[1], Blaž Kavčič[2,3], Anže Jerič[2], Monika Jenko[1] [1]IMT-Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]LPKF, Polica 33, 4202 Naklo, Slovenia, [3]Faculty of Mathematics and Physics, University of Ljubljana, Slovenia MICROPATTERNING VIA LASER DIRECT IMAGING (LDI)	
10:35	Primož Pavšič[1], Danijel Oštir[2], Ana Mladenovič[3], Sabina Kramar[3], Matej Dolenec[4], Peter Bukovec[5] [1]PMA d.o.o., Tbilisijska 61, 1000 Ljubljana, [2]VIPAP d.d., Tovarniška 18, 8270 Krško, [3]Zavod za gradbeništvo Slovenije, Dimičeva 12, 1000 Ljubljana, [4]Naravoslovnotehniška fakulteta, Aškerčeva 12, 1000 Ljubljana, [5]Fakulteta za kemijo in kemijsko tehnologijo, Aškerčeva 5, 1000 Ljubljana SEWAGE SLUDGE STABILIZATION BY BIOMASS ASH	
10:50	**ODMOR – BREAK**	
	Dvorana 1	
	Predsedujoči – Chair: Teichert, Schlesinger	
11:10	Barbara Šetina Batič[1], Luca Repetto[2], Giuseppe Firpo[2], Ugo Valbusa[2] [1]Inštitut za kovinske materiale in tehnologije, Lepi pot 11, 1000 Ljubljana, [2]Universita di Genova, Dipartimento di Fisica, Via Dodecaneso 33, 16146 Genova FOCUSED ION BEAM INDUCED DEWETTING OF A THIN Au FILM	
11:25	Ana Mladenović[1], Željko Pogačnik[2], Radmila Milačič[3], Anica Petkovšek[4], Franka Cepak[5] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, 1000 Ljubljana, [2]Salonit Anhovo, Joint-Stock Co., Vojkova 1, 5210 Deskle, [3]Department of Environmental Sciences, Jožef Stefan Institute, Jamova 39, 1000 Ljubljana, [4]University of Ljubljana, Faculty of Civil Enginerering and Geodesy, Jamova 2, 1000 Ljubljana, [5]Luka Koper, d. d., Vojkovo nabrežje 38, 6501 Koper CHARACTERIZATION OF DREDGED SEA MUD FROM THE PORT OF KOPER AND ITS POTENTIAL FOR APPLICATIONS IN CIVIL ENGINEERING – PRELIMINARY RESULTS	
11:40	Nikol Špirutová, Jaroslav Beňo, Vlasta Bednářová Department of Metallurgy and Foundry Engineering, FMMI, VŠB – Technical University of Ostrava, 17. Listopadu 15/2172, Ostrava – Poruba, Czech Republic ALTERNATIVE UTILIZATION OF CORE SAND FOR GREEN SAND SYSTEM	
11:55	Darja Kek Merl, Peter Panjan, Miha Čekada, Peter Gselman, Srečko Paskvale Jožef Stefan Institute, Jamova 39, Ljubljana TRIBO-CORROSION DEGRADATION OF PROTECTIVE COATINGS ON STAINLESS STEEL	
12:10	Tomas Elbel, Jiri Hampl VSB Technical University of Ostrava, Faculty of Metallurgy and Materials Engineering, 17. listopadu 15, 708 33 Ostrava-Poruba, Czech Republic THERMODYNAMIC ANALYSIS OF CAST IRONS SOLIDIFICATION WITH VARIOUS TYPES OF GRAPHITE	

12:25	Karel Michalek[1], Libor Čamek[1], Karel Gryc[1], Markéta Tkadlečková[1], Tomáš Huczala[2], Vladimír Troszok[2] [1]VŠB – Technical University of Ostrava, FMME, DEPARTMENT OF METALLURGY, 17. listopadu 15/2172, 708 33 Ostrava, ČR, [2]TŘINECKÉ ŽELEZÁRNY, a.s., 739 70 Třinec-Staré Město, Průmyslová 1000, ČR POSSIBILITIES OF DESULPHURIZATION OF TOOLS ALLOYED STEEL IN THE VACUUM OXYGEN DECARBURIZATION (VOD) EQUIPMENT WHILE USING CHEMICAL HEATING	
12:40	**ODMOR – BREAK**	
	Predsedujoči – Chair: Teichert, Schlesinger	
13:00	Petr Lichý, Vlasta Bednářová, Tomáš Elbel, Aleš Hanus Department of Metallurgy and Foundry Engineering, FMMI, VŠB – Technical University of Ostrava, 17.Listopadu 15/2172, Ostrava – Poruba, Czech Republic CAST CELLULAR METALS WITH REGULAR AND IRREGULAR STRUCTURE	
13:15	Filip Tikal, Michal Duchek COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic NUMERICAL SIMULATION OF RADIATION HEAT TRANSFER FROM FORGING FURNACE TO INGOTS	
13:30	[1]Sefer Avdiaj, [2]Janez Šetina University of Prishtina, Mother Teresa av 3, Pristina 10000, Kosova, Institute of Metals and Technology, Lepi pot 11, Ljubljana 1000, Slovenia EXTENSION OF THE RANGE OF PRIMARY VACUUM CALIBRATION METHODS WITH THE USE OF NONEVAPORABLE GETTERS	
	Zaključek konference – Closing the Conference	

	Dvorana 2	
	Predsedujoči – Chair: Bele, Conradi	
10:20	Boštjan Markoli[1], Iztok Naglič[1], Kristina Žužek Rožman[2], Paul John McGuiness[2] [1]University of Ljubljana, Faculty of Natural sciences and Engineering, Slovenia, [2]Institute Jožef Stefan, Ljubljana, Slovenia MAGNETIC SHAPE MEMORY EFFECT IN Ni-BASED ALLOYS	
10:35	S. Kastelic[1], J. Tušek[2], D. Klobčar[2], P. Mrvar[3] [1]Institut for Foundry and Heat Treatment, Litostrojska cesta 60, Ljubljana, [2]University of Ljubljana, Faculty of Mechanical Engineering, Aškerčeva 6, Ljubljana, [3]University of Ljubljana, Faculty of Natural Sciences and Engineering, Aškerčeva 12, Ljubljana AA413.0 AND AA1050 JOINED WITH FRICTION STIR WELDING	
10:50	**ODMOR – BREAK**	
	Predsedujoči – Chair: Bele, Conradi	
11:10	Monika Jenko[1,3], Tadej Kokalj[1], Nuša Pukšič[1,3], Miran Mozetič[2,3] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]Jožef Stefan Institute Jamova 39, 1000 Ljubljana, Slovenia, [3]Jožef Stefan Postgraduate School, Jamova 39, 1000 Ljubljana, Slovenia STUDY OF SURFACE TREATED NiTi SMA MICROSTRUCTURE	
11:25	Petr Lichý, Michal Cagala, Jaroslav Beňo Department of Metallurgy and Foundry Engineering, FMMI, VŠB – Technical University of Ostrava, 17. Listopadu 15/2172, Ostrava – Poruba, Czech Republic INVESTIGATION OF MECHANICAL PROPERTIES AND STRUCTURE OF SPECIAL NON-FERROUS ALLOYS BASED ON MAGNESIUM	
11:40	Darja Jenko[1], Monika Jenko[1,2], Tadej Kokalj[1] [1]Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia, [2]Jožef Stefan International Postgraduate School, Jamova 39, SI-1000 Ljubljana, Slovenia TEM AND STEM INVESTIGATION OF NiTi SHAPE MEMORY ALLOY TREATED IN OXYGEN PLASMA	

11:55	M. Rodríguez Ripoll[1], M. Jech[1], B. Adjassoho[1,2], C. Lechner[1,3], C. Habersohn[1,3], S. Gössinger[1,4], F. Heindl[1] [1]AC²T Research GmbH, Austrian Excellence Centre for Tribology, Viktor Kaplan Strasse 2, 2700 Wiener Neustadt, Austria, [2]Institute of Materials Science and Technology – Vienna University of Technology, Favoritenstraße 9, 1040 Vienna, Austria, [3]Institute for Production Engineering and Laser Technology – Vienna University of Technology, Karlsplatz 13, 1040 Vienna, Austria, [4]Institute for Energy Systems and Thermodynamics – Vienna University of Technology, Getreidemarkt 9/Stg.6, 1060 Vienna, Austria IMPACT OF MACHINE HAMMERING PEENING ON TRIBOLOGICAL PROPERTIES OF STEEL SURFACES	
12:10	Michal Duchek, Tomáš Kubina, Josef Hodek, Jaromír Dlouhý COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic DEVELOPMENT OF PRODUCTION OF ULTRAFINE-GRAINED TITANIUM IN CONFORM EQUIPMENT	
12:25	K. Ozdogan, U. Schwingenscholgl, M. Upadhyay Kahaly KAUST, Physical Science & Engineering, Thuwal 23955-6900, Kingdom of Saudi Arabia ANOMALOUS ENHANCEMENT OF THE THERMOELECTRIC FIGURE OF MERIT BY CO-DOPING OF V IN Nb-$SrTiO_3$	
12:40	**ODMOR – BREAK**	
	Predsedujoči – Chair: Bele, Conradi	
13:00	Hana Jirkova[1], Daniela Hauserova[2], Bohuslav Masek[1] [1]University of West Bohemia in Pilsen, Research Centre of Forming Technology – FORTECH, Univerzitní 22, 306 14 Pilsen, Czech Republic, [2]COMTES FHT, a.s., Průmyslová 995, 334 41 Dobřany, Czech Republic ENERGY AND TIME SAVING LOW TEMPERATURE THERMOMECHANICAL TREATMENT OF LOW CARBON PLAIN STEEL	
13:15	Tomas Kubina, Rudolf Pernis, Josef Boruta COMTES FHT, Prumyslova 995, 334 41 Dobrany, Czech Republic CONVERSION OF MS 70 ALPHA BRASS TORSION TEST DATA INTO HOT FORMING PROCESSING MAPS	
13:30	Vlatko Marušić, Željko Rosandić Mechanical Engineering Faculty in Slavonski Brod, Trg Ivane Brlić Ma uranić 2, Slavonski Brod, Croatia ANALYSIS OF THE INFLUENCE OF THERMOCHEMICAL TREATMENT ON STRUCTURE AND MECHANICAL PROPERTIES OF STEEL 20MnCr5	
	Zaključek konference – Closing the Conference	

POSTERSKA SEKCIJA – POSTER SESSION
SREDA – WEDNESDAY 17. 10. 2012 (19:00 – 20:00)

YR1	B. Akgenc, S. D. Gunay, C. Tasseven Kirklareli University Department of Physics, Faculty of Science, Kavakli Campus,Kavaklı, 39060, Kirklareli, Turkey, Yildiz Technical University, Department of Physics, Faculty of Science, Davutpasa Campus, Esenler, 34210, Istanbul,Turkey CLASSICAL MOLECULAR DYNAMICS SIMULATION OF PuO_2	YR-MS
YR2	I. Altinsoy, G. Celebi Efe, M. Ipek, I. Ozbek, S. Zeytin, C. Bindal Sakarya University, Engineering Faculty, Department of Metallurgy and Materials Engineering, Esentepe Campus, 54187, Serdivan-Sakarya NITRIDING OF ALVAR14® HOT WORK TOOL STEEL	YR-TO
YR3	[1–2]Ekrem Altuncu [1]Kocaeli University, Hereke Borusan Campus, Vocational School of Asim Kocabiyik, 41800 Kocaeli, Turkey, [2]Sakarya University, Thermal Spray Technology R&D Center, Esentepe Campus, 54187 Sakarya, Turkey CUTTING TOOL RECYCLING PROCESS BY ZINC MELT METHOD FOR OBTAINING THERMAL SPRAYING FEEDSTOCK POWDER (WC-Co)	YR-RN
YR4	S. M. Alvarez, A. Bautista, F. Velasco Universidad Carlos III de Madrid, Leganés, Madrid/Spain INFLUENCE OF PROCESS PARAMETER ON THE CORROSION RESISTANCE OF CORRUGATED AUSTENITIC AND DUPLEX STAINLESS STEELS	YR-KD
YR5	Aysun Ayday, Mehmet Durman Sakarya University, Faculty of Engineering, Department of Metallurgical and Materials Engineering, Sakarya, 54187, Turkey WEAR PROPERTIES OF AISI 4140 STEEL MODIFIED BY ELECTROLYTIC PLASMA TECHNOLOGY	YR-TP
YR6	Bączek Natalia, Strzelec Krzysztof, Wąsikowska Karolina, Ostrowska Sylwia Institute of Polymer and Dye Technology, Faculty of Chemistry, Lodz University of Technology, Stefanowskiego 12/16, 90-924 Lodz, Poland EPOXY RESINS CURED WITH POLYTHIOURETHANE OLIGOMERS AS A NEW CLASS OF SUPPORTS FOR METAL-COMPLEX CATALYSTS	YR-NKM
YR7	F. E. Bastan, Y. Y. Ozbek Sakarya University, Engineering Faculty, Department of Metallurgical and Metarials Engineering, 54187, Esentepe Campus, Sakarya, Turkey THE EFFECT OF BINDER ON CHEMICAL PRECIPITATED HYDROXYAPATITE DURING SPRAY DRYING	YR-NKM
YR8	P. Beraxa, L. Domovcová, Ľ. Parilák ŽP VVC s.r.o. (Research and development centre), Kolkáreň 35, 97681 Podbrezová, Slovakia EVALUATION OF SELECTED PROPERTIES OF A CVD COATED TOOL USED AT COLD FORMING PROCESS	YR-TP
YR9	Polonca Brglez[1], Andrej Holobar[1], Aleksandra Pivec[2], Mitja Kolar[3,4] [1]ECHO d.o.o., Stari trg 37, SI-3210 Slovenske Konjice, Slovenia, [2]ZRS Bistra Ptuj, Slovenski trg 6, SI-2250 Ptuj, Slovenia, [3] University of Maribor, Faculty of Chemistry and Chemical Engineering, Smetanova 17, SI-2000 Maribor, Slovenia, [4]Centre of Excellence PoliMaT, Tehnološki park 24, SI-1000 Ljubljana, Slovenia OPTIMIZATION OF OPTICAL OXYGEN SENSOR'S PROPERTIES BASED ON 4,7-DIPHENYL-1,10-PHENANTHROLINE RUTHENIUM(Ii) DICHLORIDE COMPLEX	YR-TP

YR10	Halil Çalışkan[1], Azmi Erdoğan[2], Peter Panjan[3], M. Sabri Gök[2], Abdullah Cahit Karaoğlanlı[2] [1]Bartın University, Faculty of Engineering, Department of Mechanical Engineering 74100 Bartin, Turkey, [2]Bartın University, Faculty of Engineering, Department of Metallurgical and Materials Engineering 74100 Bartin, Turkey, [3]Jožef Stefan Institute, Department of Thin Films and Surfaces, 1000, Ljubljana, Slovenia MICRO-ABRASION WEAR TESTING OF MULTILAYER NANOCOMPOSITE TiAlSiN/TiSiN/TiAlN HARD COATINGS DEPOSITED ON AISI H11 STEEL	YR-TO
YR11	Drev, S.[1], Daneu, N.[1], Kynický, J.[2], Rečnik, A.[1] [1]Dept. for Nanostructured Materials, Jožef Stefan Institute, Jamova cesta 39, SI-1000 Ljubljana, Slovenia, [2]Ústav geologie a pedologie, Mendelova Univerzita v Brně, Zemědělská 3, CZ-61300 Brno, Czech Republic HRTEM STUDY OF TAAFFEITE CRYSTALS FROM MOGOK (MYANMAR)	YR-NN
YR12	Y. Garip, N. Ergin, O. Ozdemir Sakarya University, Technology Faculty, Department of Metallurgy and Materials Engineering, 54187 Esentepe Campus, Sakarya-Turkey THE CHARACTERIZATION OF Al_2O_3-TiB_2 COMPOSITES PRODUCED BY REDUCTION COMBUSTION SYNTHESIS	YR-NKM
YR13	Ana Gantar, Nataša Drnovšek, Saša Novak Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia BIOACTIVE GLASS SCAFFOLDS FOR BONE REPAIR	YR-NKM
YR14	Sedat Karabay, E. Asim Guven, A. Tamer Erturk University of Kocaeli, Engineering Faculty, Mechanical Engineering Department, 41380, Kocaeli, Turkey PERFORMANCE TESTING OF AN OPTICAL GROUND WIRE COMPOSITES DESIGNED AND MANUFACTURED FOR TRANSMISSION LINES AND TELECOMMUNICATION SYSTEMS	YR-NKM
YR15	[1]Ekrem Altuncu, [2]Sedat Iric, [1]Fatih Ustel [1]Sakarya University, Metallurgical and Materials Eng. Dept. Thermal Spray Tech. Center, [2]Sakarya University, Machine Engineering Dept., Esentepe Campus, Sakarya, Turkey THERMAL MONITORING FOR REAL TIME TBC FAILURE ESTIMATION DURING THERMAL CYCLE TESTS	YR-KD
YR16	Marja Jerič, Miran Čeh Jožef Stefan Institute, Department for nanostructured materials, Jamova cesta 39, 1000 Ljubljana, Slovenia SYNTHESIS AND CHARACTERISATION OF Ti-SITE DOPED SrTiO3 and Sr- and Ti-SITE DOPED LAYERED PEROVSKITE $SrO(SrTiO_3)_N$ (N=1,2,3…) AS A N-TYPE THERMO-ELECTRIC MATERIAL	YR-NKM
YR17	Lubomir Klimes[1], Josef Stetina[1], Pavol Bucek[2] [1]Brno University of Technology, Faculty of Mechanical Engineering, Technicka 2896/2, Brno, Czech Republic, [2]Zeleziarne Podbrezova Research and Development Center, Kolkaren 35, 976 81 Pobrezova, Slovakia IMPACT OF CASTING SPEED ON TEMPERATURE FIELD OF CONTINUOUSLY CAST STEEL BILLETS	YR-MS
YR18	Levent Cenk Kuyruoglu, Ahmet Özel University of Sakarya, Engineering Faculty, Metallurgy and Materials Department, Esentepe Campus-Sakarya PLASMA ELECTROLYTIC SATURATION OF 316L STAINLESS STEEL IN AN UREA AND AMMONIUM NITRATE CONTAINING AQUEOUS ELECTROLYTE	YR-TP
YR19	Mediha Öbekcan[1], Aysun Ayday[1], Hüseyin Şevık[2], S. Can Kurnaz[1] [1]Sakarya Universtiy, Engineering Faculty, Department of Metallurgical and Materials Engineering, Sakarya-Turkey, [2]Mersin University, Engineering Faculty, Department of Metallurgical and Materials Engineering, Mersin-Turkey THE EDDITION OF STRONTİUM ELEMENT IN Mg-%3Sn ALLOY AND INVESTIGATION OF ITS PROPERTIES	YR-NKM

YR20	Tomáš Luks, Jaroslav Horský Heat Transfer and Fluid Flow Laboratory, Faculty of Mechanical Engineering, Brno University of Technology, Technická 2, 616 69 Brno, Czech Republic NUMERICAL SIMULATION OF PIN SENSOR IN APPLICATION FOR ROLLING FORCES MEASURING	YR-MS
YR21	Ľubomír Orovčík[1], Jaroslav Jerz[1], Martin Nosko[1], Roman Florek[1], Eugen Belica[2] [1]Račianska 75, 83102 Bratislava 3, Slovakia, Institute of Materials & Machine Mechanics, SAS, [2]Paulínska 16, 917 24 Trnava, Slovakia, Faculty of Materials Science and Technology STU in Bratislava INTERFACES AND INTERACTIONS OF ALUMINIUM MMC WITH AN ALUMINIUM ALLOY MELT	YR-NKM
YR22	D. Jenko[1], J. E. Pérez Ipiña[2], W. R. Tuckart[3], G. Prieto[3] [1]Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia Grupo Mecánica de Fractura, [2]GMF UNComa/CONICET, Buenos Aires 1400, (8300) Neuquén, Argentina, [3]Tribology Group, Universidad Nacional del Sur/CONICET, Av. Alem 1253, (8000), Bahía Blanca, Argentina EFFECT OF CRYOGENIC TREATMENTS ON MECHANICAL PROPERTIES OF AISI 420 STAINLESS STEEL	YR-TO
YR23	Aleksander Rauter, Angela Šurca Vuk, Lidija Slemenik Perše, Boris Orel National Institute of Chemistry, Hajdrihova 19, SI-1000 Ljubljana, Slovenia SOL-GEL ANTICORROSION COATINGS FOR ELECTRONIC BOARDS	YR-KD
YR24	Silvie Rosypalová, Rostislav Dudek, Jana Dobrovská, Monika Žaludová VŠB – Technical University of Ostrava, 17. listopadu 15/2172, Ostrava, 708 33, Czech Republic STUDY OF INTERFACIAL TENSION AT THE INTERFACE MOLTEN OXIDE SYSTEM/MOLTEN STEEL	YR-NKM
YR25	Hana Srbová, Tomáš Kroupa, Robert Zemčík University of West Bohemia, Univerzitní 8, 306 14 Pilsen, Czech Republic IDENTIFICATION OF MATERIAL PARAMETERS OF SUBSTITUENTS OF UNIDIRECTIONAL FIBER COMPOSITE USING MICRO-MODEL	YR-NKM
YR26	Nina Špička, Petra Forte Tavčer University of Ljubljana, Faculty of Natural Sciences and Engineering, Department of Textiles, Aškerčeva 12, Ljubljana, Slovenia BIO-SCOURING AND BIO-BLEACHING OF COTTON	YR-RN
YR27	E. Švara Fabjan[1], A. Sever Škapin[1], L. Škrlep[1], M. Otoničar[2], Ž. Nose[3], M. Bele[4], M. Gaberščček[4] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, SI – 1000 Ljubljana Slovenia, [2]Jožef Stefan Institute, Jamova cesta 39, Ljubljana, Slovenia, [3]TRC JUB d.o.o., Dol pri Ljubljani 28, 1262 Dol pri Ljubljani, Slovenia, [4]National Institute of Chemistry, Hajdrihova 19, Ljubljana, Slovenia USE OF NANOTECHNOLOGY FOR STABILITY ENHANCEMENT OF SELECTED ORGANIC PIGMENT	YR-NN
YR28	Faruk Varol, Salim Aslanlar, Ugur Ozsarac, Erdinc Ilhan [1]Department of Metallurgical and Materials Engineering, Sakarya University, Sakarya, Turkey INVESTIGATION OF WEAR PROPERTIES OF SLIDING PLATES USED IN RAILWAY VEHICLES	YR-NKM
YR29	Karolina Wąsikowska[1], Krzysztof Strzelec[1], Natalia Bączek[1], Sylwia Ostrowska[1], Juliusz Pernak[2], Bartosz Markiewicz[2] [1]Institute of Polymers & Dye Technology, Lodz University of Technology, ul. Stefanowskiego 12/16, 90-924 Lodz, Poland, [2]Institute of Technology and Chemical Engineering, Faculty of Chemical Technology, Poznan University of Technology, 2 M. Skłodowska-Curie Square, 60-965 Poznan, Poland SYNTHESIS OF NOVEL CATALYSTS SUPPORTS BASED ON EPOXY AND TIOEPOXY RESINS CURED WITH IONIC LIQUIDS	YR-NKM

30	Fares D. Alsewailem, Saad A. Aljlil King Abdulaziz City for Science and Technology (Kacst), P.O.Box 6086, Riyadh 11442 RECYCLED POLYMERS/CLAY COMPOSITES FOR HEAVY METALS ADSORPTION	NKM
31	Boštjan Arh[1], Franc Tehovnik[1], Jakob Lamut[2], Erika Bricelj[3] [1]Inštitut za kovinske materiale in tehnologije, Lepi pot 11, Ljubljana, Slovenija, [2]NTF-OVM, Aškerčeva 20, Ljubljana, Slovenija, [3]ACRONI, d.o.o., Cesta Borisa Kidriča 44, Jesenice, Slovenija CHROMIUM OXIDES IN SLAG BY THE STEELMAKING OF STAINLESS STELLS IN EAF	NKM
32	Boris Arzenšek, Franc Tehovnik, Borut Žužek, Matej Hočevar, Bojan Podgornik Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia SEGREGATION OF INTERMETALLIC PHASES IN FERRITE-AUSTENITE STAINLESS STEELS	NKM
33	Alexandra Banu[1], Maria Marcu[2], Elvira Alexandrescu[3] [1]Politehnica University from Bucharest, Splaiul Independentei 313 Bucharest, Romania, [2]Institute of Physical Chemistry "Ilie Murgulescu" of Romanian Academy, Splaiul Independentei 202, Bucharest, Romania, [3]COMOTI- R&D Romanian Institute, Bd Iuliu Maniu 220, Bucharest, Romania INNOVATIVE COATINGS FOR AIRCRAFTS STRUCTURES	KD
34	M. Kralj Novak, S. Bedenk, Z. Susteric Savatech d.o.o., R & D Institute, Skofjeloska 6, 4000 Kranj, Slovenia FREQUENCY-TEMPERATURE SUPERPOSITION IN RUBBERS	NKM
35	Erika Bricelj, Emil Šubelj, Anton Košir, Ahmed Musič, Dejan Ahec, Marjan Mencinger, Jani Novak, Marjan Kunšič, Aljoša Reven, Iztok Toma ič, Boštjan Bradaškja, Silva Pintar RCJ Jesenice, Cesta Franceta Prešerna 61, 4270 Jesenice, Acroni Jesenice, Cesta Borisa Kidriča 44, 4270 Jesenice DEVELOPMENT OF ALLOY BOILER PLATES FOR HIGH TEMPERATURES USE	NKM
36	Silvie Brožová, Pavlína Pustějovská, Simona Jursová VŠB – Technical University of Ostrava, 17. Listopadu 15, 708 33 Ostrava, Czech Republic USE OF LOW-TEMPERATURE PLASMA FOR DISPOSAL OF ELECTRIC WASTE AND EVALUATION OF SUITABILITY	NKM
37	Jaka Burja[1], Jakob Lamut[1], Matjaž Knap[1], Franc Tehovnik[2] [1]Naravoslovnotehniška fakulteta, Aškerčeva cesta 12, 1000, Ljubljana, Slovenia, [2]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia ALUMOTHERMIC REDUCTION OF ILMENITE IN STEEL MELT	NKM
38	Pavel Charvat[1], Lubomir Klimes[1] Josef Stetina[1], Milan Ostry[2] [1]Brno University of Technology, Faculty of Mechanical Engineering, Technicka 2896/2, 616 69, Brno, Czech Republic, [2]Brno University of Technology, Faculty of Civil Engineering, Veveri 95, 602 00 Brno, Czech Republic THERMAL STORAGE AS A WAY TO ATTENUATE FLUID TEMPERATURE FLUCTUATIONS – SENSIBLE VS. LATENT HEAT STORAGE MATERIALS	MS
39	Nina Daneu, Aleksander Rečnik, Slavko Bernik Department for Nanostructured Materials and Centre of Excellence NAMASTE, Jamova cesta 39, 1000 Ljubljana, Slovenia GROWTH OF ZnO GRAINS UNDER THE INFLUENCE OF INVERSION BOUNDARIES WITH DIFFERENT CRYSTALLOGRAPHIC CONFIGURATIONS	NKM
40	A.Ş. Demirkiran Sakarya University; Faculty of Engineering, Dept. of Metallurgical and Materials Engineering, Esentepe Campus, 54187, Sakarya, Turkey WEAR PROPERTIES OF PRODUCED CERAMIC BODIES WITH NATURAL ZEOLITE	NKM

41	Jana Dobrovská[1], František Kavička[2], Věra Dobrovská[1], Karel Stránský[2], Hana Francová[1] [1]Faculty of Metallurgy and Materials Engineering, VSB-Technical University of Ostrava, 17.listopadu 15, 708 33 Ostrava, Czech Republic, [2]Faculty of Mechanical Engineering, Brno University of Technology, Technicka 2, Brno 616 69, Czech Republic NEW APPROACH TO EVALUATION OF CHEMICAL MICRO-HETEROGENEITY OF CONTINUOUSLY CAST STEEL SLAB	NKM
42	M. H. Korkut[1], M. S. Gok[2], A. C. Karaoglanli[2], Y. Kucuk[3], A. Erdogan[2] [1]Department of Metallurgy Education, Firat University, 23100 Elazıg-Turkey, [2]Department of Metallurgy and Materials Engineering, Bartin University, 74100 Bartin-Turkey, [3]Department of Mechanical Engineering, Bartin University, 74100 Bartin-Turkey EFFECT OF ABRASIVE GRAIN SIZE ON WEAR BEHAVIOR OF CERAMIC COATINGS BY MICRO-ABRASION TEST	NKM
43	R. Florek[1], F. Simančík[1], A. Gleich[2], M. Nosko[1], J. Harnúšková[1] [1]IMMM SAS, Račianska 75, SK-831 02 Bratislava, Slovakia, [2]Gleich Aluminiumwerk GmbH, 24 568 Kaltenkirchen, Germany IMPACT ABSORBER OF ALUMINIUM FOAM FOR RAILWAY CARRIAGES	NKM
44	Gordana Hojnik Podrepšek, Željko Knez, Maja Habulin University of Maribor, Faculty of Chemistry and Chemical Engineering, Laboratory for Separation Processes and Product Design, Smetanova ul. 17, 2000 Maribor, Slovenia SYNTHESIS AND CHARACTERIZATION OF CHITOSAN COATED MAGNETIC NANOPARTICLES PREPARED BY DIFFERENT METHODS	NN
45	Tomáš Válek[1], Jiří Hampl[2] [1]Vítkovické slévárny, spol.s r.o., Halasova 2904/1,Ostrava – Vítkovice, 706 02, [2]Vysoká škola báňská – Technická univerzita Ostrava, 17. listopadu 15, Ostrava-Poruba, 708 33 THE CONTROL OF MICROSTRUCTURE OF ICDP IRON USING THERMAL ANALYSIS	NKM
46	M. Ipek Sakarya University, Engineering Faculty, Department of Metallurgy and Materials Engineering, Esentepe Campus, 54187 Sakarya-Turkey CHARACTERIZATION OF Cu-Cr-Zr ALLOY SYNTHESESED BY POWDER METALLURGY TECHNIQUE	NKM
47	Stanislav Jakelj[1], Franci Perko[2], Janez Katnik[2], Borut Lešnik[2], Boštjan Bradaškja[1] [1]RCJ, d.o.o. Razvojni center Jesenice, Cesta Franceta Prešerna 61, 4270 Jesenice, Department Razvoj, Cesta Borisa Kidriča 44, 4270 Jesenice, [2]Acroni,d.o.o., Cesta Borisa Kidriča 44, 4270 Jesenice DEVELOPMENT OF TECHNOLOGY FOR PROCESSING NICKEL SUPER ALLOYS	NKM
48	Ita Junkar, Martina Modic, Kristina Eleršič, Miran Mozetič Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia ALIGNMENT OF PLASMID DNA MOLECULES BY OXYGEN PLASMA	NN
49	Pavlína Pustějovská, Simona Jursová, Silvie BroMarie Radošovská VŠB – Technical University of Ostrava, 17. listopadu 15, 708 33 Ostrava, Czech Republic EVALUATION OF COAL CHARGE EFFECT ON METALLURGICAL COKE QUALITY BY STATISTICAL METHODS	NKM
50	Nuray Karakuş, H. Özkan Toplan Sakarya University, Engineering Faculty, Dept. of Metallurgy and Materials Engineering, 54187, Sakarya, Turkiye PRODUCTION OF Si_3N_4 ADDED CaO	NKM
51	František Kavička, Jana Dobrovská, Karel Stránský, Bohumil Sekanina, Josef Štětina Brno University Of Technology, Technická 2, Brno, Czech Republic A NUMERICAL ANALYSIS OF THE PRIMARY CRYSTALLIZATION OF PURE ALUMINIUM	NKM

52	Kitae Kim, Sehyun Ko, Jesik Shin Korea Institute of Industrial Technology, South Korea EFFECTS OF Si CONTENT ON THERMAL CONDUCTIVITY AND CASTABILITY OF Al-Fe-Si-Zn ALLOYS	NKM
53	Tadeja Kosec[1], Jaka Kovač[1], Uroš Mezeg[2], Jasmina Primožič[2], Andraž Legat[1] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, SI – 1000 Ljubljana, Slovenia, [2]Medical Faculty, University of Ljubljana, Zaloška 2, SI-1000 Ljubljana, Slovenija FRACTURE ANALYSIS OF NiTi DENTAL ALLOYS	NKM
54	D. Lapornik[1], Z. Samardžija[2], K. Gradišek[1], M. Čeh[2] [1]Cinkarna Celje, Kidričeva ulica 26, 3000 Celje, [2]Institut Jožef Stefan, Jamova cesta 39, 1000 Ljubljana CHARACTERIZATION OF TiO_2 NANOPARTICLES WITH HIGH-RESOLUTION FEGSEM SCANNING ELECTRON MICROSCOPY	NN
55	Won-beom Lee[1], Kyoung-mook Lim[2] [1]Liquid Heat treatment & plating technology center, KITECH, Incheon, South Korea, [2]Liquid Processing & Casting Technology R&D department, KITECH, Incheon, South Korea EFFECT OF HEAT TREATMENT ON WEAR RESISTANCE OF THE TiC-Fe COATINGS FABRICATED BY HVOF PROCESSING	NKM
56	Franjo Cajner, Darko Landek, Ivan Kumić, Amalija Vugrinčić Faculty of Mechanical Engineering and Naval Architecture (FMENA), University of Zagreb, Ivana Lucica Street No. 1, HR10000 Zagreb, Croatia INFLUENTIAL FACTORS IN THE SURFACE HARDNESS TESTING OF A NITRIDED LAYER	TP
57	[1]Kyoungmook Lim, [1]Sangsu Shin, [1]Jaesik Shin, [2]Wonbeom Lee [1]Liquid Processing & Casting Technology R&D Department, KITECH, South Korea, [2]Heat treatment & plating technology center, KITECH, South Korea CASTABILITY AND MECHANICAL PROPERTIES OF Al-Zn ALLOYS FABRICATED BY DIE-CASTING	NKM
58	Djordje Mandrino[1], David Nolan[2] [1]Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia, [2]BlueScope Steel Limited, Old Port Road, PORT KEMBLA, NSW2505, Australia EVALUATION OF MAGNESIUM AND CALCIUM OXIDE STATE IN AUGER ELECTRON SPECTROSCOPY DEPTH PROFILINGS	NKM
59	Alexandra Banu[1], Maria Marcu[2] [1]Politehnica University from Bucharest, Splaiul Independentei 313 Bucharest, Romania, [2]Institute of Physical Chemistry " Ilie Murgulescu" of Romanian Academy, Splaiul Independentei 202, Bucharest, Romania ELECTROCHEMICAL STUDIES ON POLYPYRROLE COATINGS USING AS A PRIMER FOR AIRCRAFTS STRUCTURES	KD
60	Miran Mozetič, Alenka Vesel Jožef Stefan Institute, Jamova cesta 39, 1000 Ljubljana, Slovenia THERMAL DE-FUNCTIONALIZATION OF OXYGEN PLASMA TREATED POLYETHERSULPHONE	NKM
61	Martin Nosko, František Simančík, Roman Florek Račianska 75, 83102 Bratislava 3, Slovakia, Institute of Materials & Machine Mechanics, SAS FATIGUE BEHAVIOR OF ALUMINIUM FOAM	NKM

62	B. Baručija[1], M. Oruč[1], O. Beganović[1], M. Rimac[1], S. Muhamedagić[2] [1]Metallurgical Institute "Kemal" Zenica, University of Zenica, Travnička cesta7, Zenica, Bosnia and Herzegovina, [2]Faculty of Metallurgy and Materials, University of Zenica, Travnička cesta1, Zenica, Bosnia and Herzegovina INFLUENCE OF THERMOMECHANICAL PROCESSING ON COLD DEFORMABILITY OF LOW CARBON STEEL WITH NITROGEN CONTENT > 70ppm WHICH IS DEOXIDIZE WITH ALUMINIUM	NKM
63	Milan Ostry[1], Radek Prikryl[2], Pavel Charvat[3] [1]Brno University of Technology, Faculty of Civil Engineering, Institute of Building Structures, Veveri 95, 602 00 Brno, Czech Republic, [2]Brno University of Technology, Faculty of Chemistry, Purkynova 464, 612 00, Brno, Czech Republic, [3]Brno University of Technology, Faculty of Mechanical Engineering, Technicka 2896/2, 616 69, Brno, Czech Republic CHARACTERIZATION OF SELECTED PHASE CHANGE MATERIALS FOR PROPOSED USE IN BUILDING APPLICATIONS	TO
64	F. E. Bastan, Y. Y. Özbek Sakarya University, Engineering Faculty, Department of Metallurgical and Metarials Engineering, 54187, Esentepe Campus, Sakarya, Turkey PRODUCING ANTI-BACTERIAL SILVER DOPED HYDROXYAPATITE POWDERS WITH CHEMICAL PRECIPITATION AND RESHAPING AT SPRAY DRYER	NKM
65	Faruk Varol[1], Mehmet Ekici[2], Ugur Ozsarac[1], Salim Aslanlar[1], Erdinc Ilhan[3] [1]Department of Metallurgical and Materials Engineering, Sakarya University, Sakarya, Turkey, [2]Vocational School of Yalova, Yalova University, Yalova, Turkey, [3]Department of Mechanical Engineering, Sakarya University, Sakarya, Turkey INVESTIGATION OF FATIGUE PROPERTIES OF TRAIN BRAKE PADS MANUFACTURED FROM CAST IRON AND CARBON-CARBON COMPOSITES	NKM
66	Nikola Bajić[1], Slobodan Stojadinović[2], Jasmina Pekez[2], Tasić Ivan[2] IHIS Research and Development Center, Batajnicki put 23, 11 000 Belgrade, Serbia, University of Novi Sad, Technical Faculty "Mihajlo Pupin", Đure Đakovića bb, 23 000 Zrenjanin, Serbia FULL AND FLUX-CORED ACTIVATED WIRE APPLICATION FOR ARC WELDING OF LOW CARBON STEEL IN CO_2 AND CO_2 GAS MIXTURES	NKM
67	Irena Petrinič[1], Thomas Luxbacher[2], Hermina Bukšek[1], Aljana Petek[1] [1]University of Maribor, Faculty of Chemistry and Chemical Engineering, Smetanova 17, 2000 Maribor, Slovenia, [2]Anton Paar GmbH, Anton-Paar-Strasse 20, 8054 Graz, Austria THE MEMBRANE SURFACE CHARACTERIZATION: ZETA POTENTIAL AND CONTACT ANGLE MEASUREMENTS CORRELATION	TP
68	Pustějovská, P., Jursová, S., Radošovská, M. VŠB-Technical University, Cenet, 17. listopadu 15, Czech Republic EVALUATION OF COAL CHARGE EFFECT ON METALLURGICAL COKE QUALITY BY STATISTICAL METHODS	MS
69	[1]Aleksander Rečnik, [2]Lei Jin, [2]Lothar Houben, [1]Janez Zavašnik, [1]Nina Daneu [1]Department for Nanostructured Materials, Jožef Stefan Institute, 1000 LJUBLJANA, Slovenia, [2]Ernst Ruska-Centre and Institute for Microstructure Research, Jülich Research Centre, 52425 Jülich, Germany HRTEM AND HAADF-STEM STUDY OF {110} TWINS IN PYRITE	NN
70	Jesik Shin, Kyoungmook Lim, Kitae Kim, Taehyeong Kim, Sangmok Lee Korea Institute of Industrial Technology, 7-47, Songdo-Dong, Yeonsu-Gu, Incheon, South Korea EFFECT OF GRAPHITE SHAPE OF SOLID IRON ON INTERFACIAL BONDING CHARACTERISTIC OF ALUMINUM-CAST IRON BIMETALS	NKM
71	D. A. Skobir Balantič, F. Vodopivec, B. Žužek, M. Jenko, M. Godec Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana CALCULATION OF STATIONARY CREEP RATE FOR TEMPERED MARTENSITE	NKM

72	Lidija Slemenik Perše, Aleksander Rauter, Angela Šurca Vuk, Boris Orel National Institute of Chemistry, Hajdrihova 19, SI-1000 Ljubljana, Slovenia RHEOLOGY: IMPORTANT TOOL FOR DETERMINATION OF PROPERTIES OF SOLS FOR ANTICORROSION COATINGS DEPOSITION	KD
73	Darja Steiner Petrovič, Nuša Pukšič, Fevzi Kafexhiu, Franc Vodopivec, Bojan Podgornik Institute of Metals and Technology, Ljubljana, Slovenia THERMO-KINETIC SIMULATION OF V AND Nb DISTRIBUTION IN HIGH CHROMIUM, CREEP-RESISTANT POWER PLANT STEELS	KNM
74	Klemen Stopar[1], Miha Kovačič[1], Peter Kitak[2], Jože Pihler[2] [1]Štore Steel d.o.o., @elezarska cesta 3, 3220 Štore, [2]Faculty of Electrical Engineering and Computer Science., Smetanova ulica 17, 2000 Maribor ELECTRIC ARC FURNACE PRODUCTIVITY OPTIMIZATION	NKM
75	František Kavička[1], Karel Stránský[1], Bohumil Sekanina[1], Josef Štětina[1], Tomáš Mauder[1], Jana Dobrovská[2], Miloš Masarik[3] [1]Faculty of Mechanical Engineering, Brno University of Technology, Technicka 2, Brno 616 69, Czech Republic, [2]Faculty of Metallurgy and Materials Engineering, VSB-Technical University of Ostrava, 17.listopadu 15, 708 33 Ostrava, Czech Republic, [3]EVRAZ VÍTKOVICE STEEL, a.s. Ostrava, Czech Republic INFLUENCE OF CHEMICAL COMPOSITION OF A STEEL ON THE TEMPERATURE FIELD OF CONCAST SLAB	NKM
76	Marjan Suban, Borut Bundara, Robert Cvelbar Institute of metal constructions, Mencingerjeva 7, Ljubljana, Slovenia ENVIRONMENTAL EVALUATION OF WELDED VS. BOLTED JOINTS IN STEEL CONSTRUCTIONS	VO
77	Karel Suhajda, Miloslav Novotny, Jan Skramlik, Milan Ostry, Jana Krupicova, Pavel Schmid, Vladimir Tichomirov Brno University of Technology, Faculty of Civil Engineering, Department of Building Structures, Veveri 331/95, Brno 602 00 INFLUENCE OF MICROWAVE RADIATION ON THE STRENGTH CHARACTERISTICS OF CERAMIC BODY	NKM
78	Luka Škrlep[1], Andrijana Sever Škapin[1], Jonjaua Ranogajec[2] [1]Slovenian National Building and Civil Engineering Institute, Dimičeva 12, SI – 1000 Ljubljana Slovenia, [2] Faculty of Technology, University of Novi Sad, Bul. Cara Lazara 1, Novi Sad, 21000, Serbia DEVELOPMENT OF CONSOLIDANTS BASED ON THE SOLUBLE CALCIUM COMPOUNDS FOR HARDENING OF HISTORICAL INORGANIC MATERIALS	NKM
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84	Eda Elmas, Kenan Yildiz, Nil Toplan, H. Özkan Toplan Sakarya University, Engineering Faculty, Department of Metallurgy and Materials Engineering, 54187 Sakarya Turkey THE EFFECT OF MECHANICAL ACTIVATION ON MULLITE FORMATION IN ALUMINA-QUARTZ CERAMICS SYSTEM	NKM
85	Yeşim Sert, Nil Toplan University of Sakarya, Department of Metallurgical and Materials Engineering (M7), Esentepe Campus, 54187 Sakarya, TURKEY TRIBOLOGICAL BEHAVIOR OF PLASMA SPRAYED Al_2O_3-TiO_2 COATING	TP
86	Bogdan Valentan[1], Tjaša Zupančič Hartner[1], Igor Drstvenšek[2,1] [1] Ortotip d.o.o., Ulica Skofa Maksimiljana Drzecnika 6, SI-2000 Maribor, [2] University of Maribor, Faculty of Mechanical Engineering, Smetanova ulica 17, SI-2000 Maribor PROCESSING PEEK (POLYETHER ETHER KETONE) ON 3D PRINTER FOR THERMOPLASTIC MODELING	RN
87	Stojana Veskovič[1], Irena Paulin[2], Črtomir Donik[2], Matjaž Godec[2] [1]Hidria AET d.o.o., Poljubinj 89a, SI-5220 Tolmin, Slovenia, [2]Institute of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia SURFACE OXIDATION OF HEATING RESISTORS IN GLOW PLUGS	KD
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89	T. Vuherer[1], P. Maruschak[2], V. Gliha[1] [1]University of Maribor, Faculty of Mechanical Engineering, Slovenia, [2]Ternopil Ivan Pul'uj National Technical University, Ukraine BEHAVIOUR OF SMALL CRACKS EMANATING FROM TINY DRILLED HOLES	NKM
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93	M. Balcar, L. Sochor, J. Novák, L. Martínek, P. Martínek, P. Podaný, J. Bažan ZDAS, Inc., Strojírenská 6, P.O.BOX 145, Czech Republic PRODUCTION AND HEAT TREATMENT OF DUPLEX STAINLESS STEEL FORGINGS	NKM
94	Črtomir Donik, Aleksandra Kocijan, Monika Jenko Institute of Metals and Technology, Lepi pot 11, 1000 Ljubljana, Slovenia COMPARISON OF AN XPS AND AES RESULTS ON A THIN OXIDE LAYER ON DUPLEX STAINLESS STEEL	NKM
95	Aleksandra Kocijan, Marjetka Conradi Institute of metals and technology, Lepi pot 11, 1000 Ljubljana, Slovenia EFFECT OF MODIFIED SILICA/EPOXY NANOCOMPOSITE COATINGS ON THE STEEL SUBSTRATE CORROSION PROTECTION	NKM
96	Irena Paulin[1], Črtomir Donik[1], Peter Cvahte[2], Matjaž Godec[1] [1]Institut of Metals and Technology, Lepi pot 11, SI-1000 Ljubljana, Slovenia, [2]IMPOL, d.o.o., Partizanska 38, SI-2310 Slovenska Bistrica, Slovenia MICROSTRUCTURE CHARACTERIZATION OF ALUMINUM ALLOYS AA 6062A-T6	NKM

20. JUBILEJNA KONFERENCA O MATERIALIH IN TEHNOLOGIJAH

17.–19. oktober 2012, Kongresni center GH Bernardin, Portorož, Slovenija

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17–19 October 2012, Congress Centre GH Bernardin, Portorož, Slovenia

KNJIGA POVZETKOV

BOOK OF ABSTRACTS

GLASS-FORMING $Ti_{75}Zr_{10}Si_{15}$-BASED ALLOYS FOR IMPLANT APPLICATIONS

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The aim of this work is to develop new biocompatible Ti-based metallic glasses for implant applications. The base system $Ti_{75}Zr_{10}Si_{15}$ has been selected mainly due to its composition of non-toxic and biocompatible elements. The effect of the additional alloying element Nb on glass-forming ability, microstructure, mechanical and chemical properties is under investigation.

The emphasis on amourphous alloys originates from the fact that they have mostly lower Young's modulus and higher strength values in comparison with conventional crystalline ones. This made them demandable for implant applications, where a lower Young's modulus is desired for reducing stress shielding effects at a bone/implant interface.

Preparation of the alloy ingots has been done by arc-melting. Melt-spinning and injective copper mould casting have been applied for producing ribbons, rods and plates.

$Ti_{75}Zr_{10}Si_{15}$ arc-melted buttoms consist of two intermetallic phases S1: $(Ti,Zr)_5Si_3$ and S2: $(Ti,Zr)_2Si$ and α-Ti solid solution, while addition of Nb suppress formation of one of the intermetallics (S2). The low glass-forming ability of both systems resulted in ribbons exhibiting composite structure of β-type nanocrystals embedded in a glassy matrix. Increasing the melt temperature yields higher fractions of glassy phase. By adding Nb small effect on glass forming ability of the system noticed.

For evaluation of the Corrosion behavior of $Ti_{75}Zr_{10}Si_{15}$ and $Ti_{60}Zr_{10}Nb_{15}Si_{15}$ ribbon and rod samples were objected to potentiodynamic polarization studies in Ringer solution at 310K. Comparative studies were done on some other relevant systems: Ti, Zr, Ti40Nb and Ti6Al4V. It was demonstrated that $Ti_{75}Zr_{10}Si_{15}$ and $Ti_{60}Zr_{10}Nb_{15}Si_{15}$ alloys are passivated in a wider potential range and at a lower passive current density level. No pitting was observed which is indicative for a strong protective effect of the surface films.

The financial support provided by the European Commission (FP7 Marie Curie ITN "BioTiNet" – 264635, www.biotinet.eu) is gratefully acknowledged.

DEVELOPMENT OF FOUNDRY CORES BASED ON INORGANIC SALTS

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The aim of this study is description of possibilities of salt cores utilization for gravity and low-pressure and high-pressure die casting technology. Determination of primary, secondary and finally residual strengths were carried out in order to evaluation of possibilities of salt cores utilization. Furthermore, this contribution is focused on composite salt development with higher mechanical properties. Solubility of cores and facility of its reclamation closed cycle with positive impacts on environment were also studied.

APPLICIABILITY OF THIN CERAMIC COATINGS FOR MAGNESIUM ALLOYS BY SOL-GEL METHOD

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Magnesium and its alloys have been widely used in automobile and computer parts, aerospace components, mobile phones, sporting goods, handheld tools and household equipments due to their lightweight. Their applications are, nevertheless, still limited on account of their relatively poor surface corrosion and wear resistance. One of the ideal approaches to overcome the inherent drawbacks is to deposit a protective coating on magnesium alloys. The sol-gel process has been utilized to fabricate, ceramic coatings on magnesium alloy. The objective of this study is to comparatively investigate the process and properties of the repeated direct sol-gel and the ceramic (ZrO_2, Al_2O_3) coatings. The coatings were characterized and the effects of the process on their properties were analyzed comparatively.

FABRICATION AND MAGNETIC PROPERTIES OF CoPt NANOSTRUCTURES

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Ferromagnetic nanowires and nanotubes based on CoPt alloy have been successfully fabricated with low cost and well known method of template assisted electrodeposition. Track etched polycarbonate (PC) templates are used; the electrolyte contained Pt-p-salt and Co-Sulphamate. Nanowires having diameter 200 nm and length 10 μm and nanotubes with diameter 200 nm and length 2 μm were obtained. Nanotubes with different wall thicknesses were obtained by varying the thickness of the gold (Au) bottom layer resulting also in nanowires for the case the pores of the template were completely filled. [1]

X-rays diffraction (XRD) reveals the FCC CoPt crystal structure for nanowires and nanotubes. FCC phase has lower magnetocrystalline anisotropy than FCT phase and the coercivity. [2] The magnetic properties depend on geometry and size of the nanostructures. For instance high aspect ratio (length/radius) nanocylinders prefer to align easy axis parallel to the axis of nanocylinder and vice versa. This change of easy axis with changing aspect ratio is associated with change in shape anisotropy and demagnetization field. [3] We have observed easy axis alignment perpendicular to the axis of the nanocylinders. Easy axis was determined with vibration sample magnetometry (VSM).

Domain structure, domain walls and spin configuration in nano-structures were explored with magnetic force microscope (MFM). Magnetization reversal in nanostructures can happen through coherent, curling and transverse reversal mode. In order to get the deep insight of magnetization reversal angular dependence of coercivity is performed.

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[3] X.-F. Han, S. Shamaila, R. Sharif, J.-Y. Chen, H. R. Liu, D. P. Liu, Advanced Materials (2009), 21, 4619–4624.

EXPERIMENTAL STUDIES OF THE POLYMERIC HOLLOW FIBER HEAT EXCHANGERS

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Polymers as construction materials have a number of benefits in comparison with metals. The main advantages of using polymers in the design of heat exchangers are as follows: low density (which promotes lighter construction), excellent chemical resistance, smooth surface (which begets low friction and good fouling characteristics). Moreover usually polymers are less expensive and easier to shape, form and machine.

Nevertheless the application of polymers as a material used in of heat exchangers is low because of the low values of polymer's thermal conductivity. It is the main parameter which limits the use of polymeric heat exchangers only for specified fields. On the other hand growth of the overall technological level and the development in the field of material sciences requires reconsideration of the possibility of polymer materials being used for heat exchanger design needs. The number of scientific works which were published over the last decade details the competitiveness of polymers in the case of fulfillment of certain conditions. In order to overcome the low thermal resistance of polymers, the two main approaches exist. The first one is to increase material thermal conductivity of the material and the second is to use thin walls between heat transfer mediums.

The polymeric hollow fiber heat exchanger (PHFHE) is a modern type of apparatus which uses polymeric fibers, with a small diameter of around 1 mm, to separate the heat transfer mediums. These fibers can be produced by extrusion process from wide range of polymers such as PP (polyethylene), PE (polyethylene), PEEK (poly-ether-ether-ketone). As it was shown in [1] and [2] polymeric hollow fiber heat exchangers can show similar thermal performance as conventional metal ones but have a number of benefits.

The polymeric heat exchangers from hollow fibers were developed and tested in the Heat Transfer and Fluid Flow Laboratory at Brno University of Technology. Heat exchangeres were built based on polypropylene hollow fibers with an outer diameter from 0.4 to 0.8 mm. They were tested for both counter flow and cross flow for water-air and water-water applications. The results of the thermal performance test are described in the paper.

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EXTENSION OF THE RANGE OF PRIMARY VACUUM CALIBRATION METHODS WITH THE USE OF NONEVAPORABLE GETTERS

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Measurement of ultrahigh vacuum (UHV) and extremely high vacuum (XHV) is important in many advanced research and technology fields such as: equipment for surface analyses, particle accelerators, simulation of interstellar space, processing of advanced semiconductors, Fe Displays, etc. For traceable calibrations of UHV and XHV gauges we need adequate primary standards which deduce the pressure unit to corresponding base SI units. Primary standards for high and ultrahigh vacuum are normally pressure generators, which are realized and maintained at national metrological laboratories at the highest level.

Since the main residual gas in UHV and XHV systems (after a suitable bake-out to remove adsorbed water) is hydrogen, the ultimate pressure and lowest limit of pressure which can be generated with high precision in primary vacuum calibration methods (static expansion and continuous expansion) is determined by the hydrogen outgassing of vacuum calibration chambers. We used Nonevaporable getter (NEG) pumps because they have zero pumping speed for noble gases and large pumping speed for active gases, especially for hydrogen. A study of reduction of hydrogen outgassing rate from stainless steel was performed. The outgassing rate of $q = 5.7 \times 10^{-14}$ mbar l s^{-1} cm^{-2} was achieved in stainless steel 304L vacuum chamber at room temperature after heat treatment the system for $F_0 = 11.75$ (F_0 – Fourier number).

We have constructed a model XHV dynamic expansion calibration system with a built-in NEG pump. The ultimate pressure in the calibration chamber of the order of 2×10^{-12} mbar was achieved. System is equipped with a gas flowmeter for very low flows of inert gases, with lower limit of gas flow 3×10^{-12} mbar l s^{-1}. The lower limit of gas flow was reached using NEG pump in the flowmeter. By using NEG pump in the flowmeter practically the hydrogen's outgassing was diminished. With this flowmeter it was possible to generate calibration pressure of argon gas down to 8×10^{-13} mbar. Operation of XHV calibration system has been demonstrated by calibration of two extractor ionization gauges.

USE FRACTAL GEOMETRY TO DESCRIBE POROSITY OF ROBOT LASER HARDENED SPECIMENS WITH OVERLAP

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Porouse structure in material is one of important mechanical property which impact on hardness of materials. Our study was limited on tool steel standard label DIN standard 1.7225. We hardened material with overlap laser beam. We can not apply Evclidian geometry to describe porouse of hardened specimens, thus we use very good method, fractal geometry. The specimen test section had a cylindrical form dimension 25×10mm (diameter×high). Microstructure of specimens was observed with an field emission scanning electron microscope JSM-7600F JEOL company. To investigate the possibility of application of fractal analysis to heat-treated surface, we have examined the relation between surface porosity and fractal dimensions depending on various parameter of temperature of robot laser cell. Also we present temperature of robot laser cell impact on poruse specimens in process of robot laser hardening. Relationship was obtained by the three layer neural network.

CAST CELLULAR METALS WITH REGULAR AND IRREGULAR STRUCTURE

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The appropriate way to reduce the weight of manufactured parts without adversely affecting their strength is the use of porous metallic materials with different internal arrangement of intentionally created cavities. Porous metallic materials can be made from liquid metal, from powdered metal, metal vapours, or from metal ions. The aim of research conducted at the department of metallurgy and foundry engineering of VSB-Technical University Ostrava is to verify the possibilities of production of metallic foams by conventional foundry processes, to study the process conditions and physical and mechanical properties of metal foams produced.

STRUCTURAL ORDERING OF ALLOYED Pt-Cu NANOPARTICLES AFFECTS DECISIVELY THEIR ELECTROCATALYTIC ACTIVITY AND STABILITY

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Electrocatalysis is a phenomenon occurring in various devices and processes such as fuel cells, metal-air batteries, electrolyzers, corrosion. It has been shown on many examples that the slow rate of oxygen reduction reaction (ORR) can be enhanced by replacing the conventional platinum electrocatalyst with bimetallic structures. The enhancement has been explained by the so-called substrate-induced strain and/or the ligand effect through d-band center shift induced by the transition element, when in contact with platinum.
On the example of a family of Cu-Pt alloys synthesized under many different conditions we show that the degree of structural ordering (ordered Pm3#m and disordered Fm3#m phase) determines crucially the alloy's electrocatalytic activity and stability after cycling. The additional activity enhancement of at least a factor of 2 is possible if the alloys are ordered.

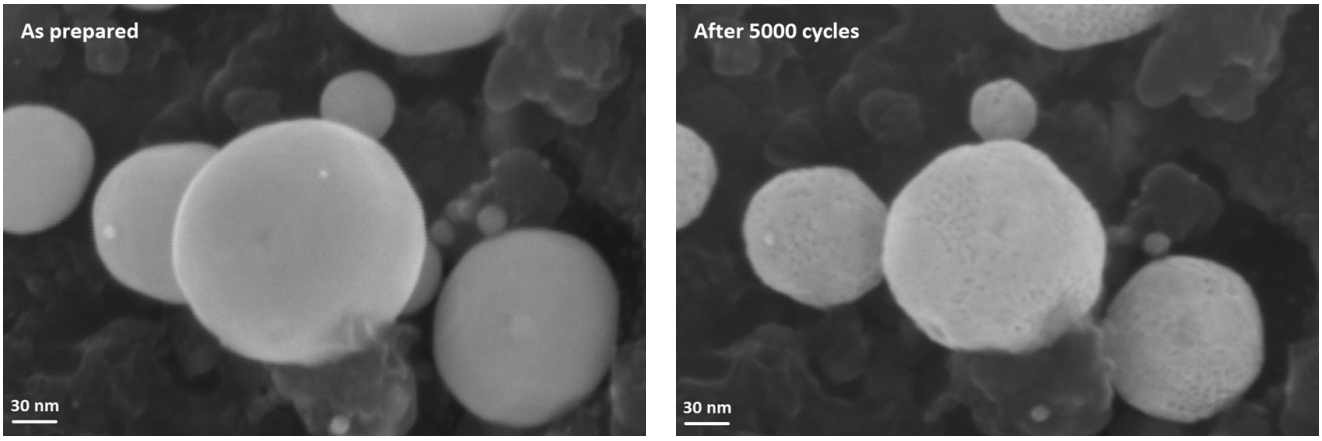

Figure: SEM pictures of alloyed Pt-Cu nanoparticles embedded on carbon, as prepared and after 5000 cycles measured with 0,1 V/s between –0,2 and –0,9V (vs. Ag/AgCl) in 0,1 M $HClO_4$.

ALTERNATIVE UTILIZATION OF CORE SAND FOR GREEN SAND SYSTEM

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Foundry industry as other human activities is connected with production of various wastes. These secondary products of manufacture are mainly composited by molding mixture, dust waste, fire refractory materials and by other wastes. Utilization of waste molding mixture, especially cores sand based on organic resins, as a replacement of new sand can be a way how to decrease a portion of molding mixture waste, thus decrease a negative impact on environment. Nowadays the most preferred technology for molds manufacture is green sand system with clays (bentonite) as a binder.
The aim of this study is determination of influence of core sand addition on mechanical; physico – chemical and technological properties of green sand system.

DETERMINATION OF MECHANICAL PARAMETERS OF BONDED JOINT BETWEEN METAL AND COMPOSITE BY COMPARING EXPERIMENTS WITH FINITE ELEMENT MODELS

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The main goal of this work is the determination of mechanical properties of the bonded joint modelled using cohesive elements in commercial finite element software Abaqus. Mechanical properties of the joint are identified using optimization method implemented in OptiSLang software. Identification is performed by minimizing the difference between force-displacement diagram obtained from numerical analyses and from experiments. The shapes of specimen and the bonded joint were designed in accordance with joints commonly used in machine industry.

BIOCERAMICS FOR SKELETAL REPAIR

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Bone is a highly complex structure that serves to support the human body, protect vital organs and maintain the mineral balance in the body. However, the natural tissue suffers from a number of degenerative diseases, which are now occurring with increasing prevalance due to the ageing population. Synthetic hydroxyapatite ($Ca_{10}(PO_4)_6(OH)_2$) is a calcium phosphate of interest for bone repair due to its similarity in composition with bone mineral. In order to create materials which match more closely the chemistry of bone mineral, substituted apatites have been prepared to encourage more rapid bone attachment.

Calcium phosphates have also been used in bioactive and biodegradable composites. It has been found that the dimensions of the bioactive reinforcing phase can have a significant influence on the mechanical- and biological performance of polymer matrices. In addition, the dissolution of the calcium phosphate filler can mediate the degradation and local pH around the implant. Composites based on both natural and synthetic organic materials and reinforced with calcium phosphates have revealed significantly enhanced levels of bioactivity in-vitro and in-vivo. A recent success in this area has been the development of a controlled collagen-glycosaminoglycan-calcium phosphate system, which allows a generic approach to cartilage repair.

However, in many orthopaedic applications, there still remains the issue of interfacing biological systems with metallic implants and to this end, a number of different of methods are being developed to apply bioactive coatings to metallic and polymeric substrates. The techniques that are available include plasma spraying, electrohydrodynamic atomisation, plasma electrolytic oxidation and RF magnetron sputtering and each of these provide surfaces with a range of topographical and compositional characteristics that can be controlled at a range of length-scales.

This lecture will consider a number of examples of developments in which novel biomaterials involving hydroxyapatite have been translated from laboratory concepts to clinical applications and the ideas and research activities on-going in the area of substituted apatites to explore the prospects for a new generation of orthopaedic biomaterials.

NUMERICAL MODELING AND EXPERIMENTAL RESULTS OF LASER SURFACE HARDENING

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Laser surface hardening is heat treating process that is commonly applied for local improvement of mechanical properties such as strength, hardness and wear/fatigue resistances on surface of workpiece. Depending of parameters during heat treating process different temperature profiles are established and various kinds of microstructures are evolved in a mechanical part. Prediction of evolution of phase transformations during laser heating and quenching is essential for calculating deformation and residual stresses after heat treating in workpiece. This study focuses on comparison of final state of microstructure in workpiece between computer simulation of laser hardening and experimental results by different heat treating parameters as validation for further investigation of thermo-mechanical response of laser hardening. Three dimensional finite-element model (FEM) has been developed to simulate heat transfer, evolution of microstructure and to predict the thermal properties in the heat affective zone during heating and cooling for laser hardening. Power distribution of laser beam, nominal laser power and velocity of laser beam are essential input parameters which effect evolution of microstructure, physical properties and also the final state of workpiece. Various experiments were made with different laser power and beam velocity with 3 kW high power diode laser (HPDL) on workpieces of simple geometrical shapes made of material C45.

INFLUENCE OF ASYMMETRY IN kMC SIMULATIONS OF PRECIPITATION IN ALLOYS

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Main focus of this paper is dynamic and kinetic development of atomic systems using computational materials science. Particular method used here is kinetic Monte Carlo (kMC), which is based on the statistical mechanics [1–5], and enables study of atomistic systems in real time. Within the framework of the study detailed simulations on the binary Fe-Cu alloy systems were employed to study asymmetry of interatomic potentials on evolution of precipitates fraction and density, volume fractions of chemical elements, precipitate size and short range order.

Simulations show that precipitation kinetics and kinetic pathways are very sensitive to the asymmetry of interatomic potentials, which was studied through definition of the asymmetry parameters. In the present work new asymmetry model has been proposed, which beside energies between atoms, also considers ghost energies between vacancy and atoms. It was observed that for the negative asymmetry parameters, coarsening by diffusion and direct coagulation of clusters dominated over Ostwald ripening mechanism, while the opposite holds for positive asymmetry parameters or symmetrical model. For long times, the time exponent of the mean radius of clusters obtained from simulations were compared to the prediction of LSW theory.

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DETERMINATION OF SN CURVES OF SPRING STEEL MATERIAL AS A FAST AND RELIABLE METHOD USING A HIGH-FREQUENCY PULSATOR CRACKTRONIC

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The dynamic property of a given material is mostly expressed by its SN curves. Since the classical determination of SN curves involves testing on specimens at low frequencies, resulting with longer testing time, a faster method for determination of SN curves is required. Cracktronic pulsator is one of most used operating machines for SN curve determination. Generally, by using cracktronic pulsator it is possible to reduce the testing time by six times, as the operating frequencies for classical method and cracktronic pulsator are 30 Hz and 180 Hz, respectively. This time reduction of testing may be from high importance during developing and simulation of a new part. Furthermore, for extending and proving an existing database in FEM based software it is also necessary to have fast and valid information about dynamic properties of selected material.

During investigation of SN curves, standard Charpy V-notched specimens were used in bending loading condition with the constant amplitude. All specimens were cut off from high-quality flat spring steel 51CrV4. After machining specimens were heat-treated, first quenched in nitrogen and then tempered at two different tempering temperatures. Also, the specimens were divided into two groups of different orientation relative to the intensity of alloying elements, parallel and perpendicular to the segregation orientation of alloying elements. Obtained new SN curves were compared to existing SN curves acquired by classical fatigue testing in compression-tension mode of loading. At the end of investigation, loading simulation of a leaf spring is performed in order to assess the fatigue life of the real spring with exact dimensions.

MODELLING OF GRAIN SIZE DISTRIBUTION IN SPRING STEEL MICROSTRUCTURE

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The distribution of grain sizes is an important parameter for describing geometrical features of microstructure as well as controlling the properties of materials. There are various experimental methods for determining the grain size distribution on microstructure; however there is a little information on efficiency of grain size estimation from the measurements performed on metallographic planes. Quantitative optical microscopy studies on steel microstructure revealed that the accuracy of grain size measurements is complicated by a number of factors which can lead to large errors in measurement. In order to determine the accuracy of methods for grain size distribution a modelling approach is presented. Demonstration of applicability of these methods was performed in computationally generated random grains varying in shape and size. It was therefore concluded that the method presented in this study allows access on information not accessible experimentally and can be applied regardless of grain shape.

INFLUENCE OF ALUMINIUM ALLOYS RE-MELTING ON THE STRUCTURE AND MECHANICAL PROPERTIES

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Nowadays common foundries try to solve relevant problem with increasing efforts on casting quality with minimum operating costs. Foundries have to decrease running costs of casting production and utilization of re-melting material is more frequently used.
Influence of repeated using of alloys on base Al – Cu (alloy RR.350) is the goal of this study. From poured samples the testing rods were prepared to determination of tensile strength under laboratory (20 °C) and under higher temperature (with maximum about 350 °C). Specimens were also subjected for hardness tests (HBS) and metallographic analysis from poured samples. At the experimental part of this study hardness of experimental samples, which were prepared at different melts with further determination of chemical composition by spectral method analysis, are evaluated. The results of this study definitely confirmed negative influence of repeated using studied alloy on thermo-mechanical and structure properties. At the conclusion of this study there are also described possibilities of further treatment and machining of studied material (inoculation and further precipitation hardening).

INTENSIVE QUENCHING AND APPLICATION FOR PARTS PRODUCTION

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Intensive quenching is a quenching process which produce maximum compressive stresses. Such process results in a dramatic reduction in cracking relative to conventional processes. Besides that mechanical properties of the components are increased mainly fatigue life.
In this lecture examples of application in parts production will be provided and a brief description of intensive quenching metallurgy will be also provided.

EXPERIMENTAL INVESTIGATION OF THE HEAT TREATMENT IN CONTINUOUS LINES

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A special apparatus was developed in order to study cooling of the vertically oriented hot steel surfaces by full cone nozzles. This apparatus allowed movement of the test sheet in the vertical direction up and down. Experiments with different water pressures and flow rate were conducted. It was observed, that the value of the average heat transfer coefficient is increasing with increasing water pressure within all the surface temperature range and that the dependence of the heat transfer coefficient on the water impingement density is linear in the region of stable film boiling. A mathematical model based on regression analysis for predicting heat transfer coefficient in the region of stable film boiling was developed.

EFFECT OF SILICA/PVC COMPOSITE COATINGS ON STEEL-SUBSTRATE CORROSION PROTECTION

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We focus on the preparation of thin polymer coatings synthetized from 30-nm and 600-nm silica particles dispersed in polyvinyl chloride (PVC) and deposited on two different steel substrates: duplex DSS 2205 and austenitic AISI 316L steel. We show that a silica surface modification with silane $IO_7T_7(OH)_3$ (trisilanol isooctyl polyhedral oligomeric silsesquioxane, POSS) significantly improves its dispersion properties when mixed with PVC. For comparison, the surface morphology and surface roughness of PVC coatings filled with both silanated and as-received (non-silanated) silica fillers is analyzed with scanning electron microscopy (SEM) and atomic force microscopy (AFM) when sprayed on the steel surface. The effect of the silica silanization is later on reflected in a decreased average surface roughness in the silanated, compared to non-silanated, silica/PVC-coatings. The wetting properties of the silanated and non-silanated silica/PVC-coatings on DSS 2205 and AISI 316L are investigated using contact-angle and surface-energy measurements, indicating an increased surface hidrophilicity in terms of a decreased static water contact angle and an increased total surface energy compared to the uncoated specimens. Finally, the beneficial corrosion resistance of the silica/PVC coatings will be confirmed with potentiodynamic polarization spectroscopy in a 3.5% NaCl solution.

MONITORING OF CORROSION PROCESSES OF STEEL IN CONCRETE IN CHLORIDE ENVIRONMENT

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Corrosion in concrete is a world wide problem, which is specially prominent in marine environments. The corrosion process itself is usually not uniform, thereby it is difficult to monitor. Namely, in the presence of chlorides pitting corrosion is very common.. There are several methods to monitor steel corrosion in concrete. All of them have their specific advantages and also disadvantages. A coupled multi-electrodes array for measurement of partial current was designed. It enables to separately monitor local anodic and cathodic processes on the thin electrodes with ZRA system.

The measurements on multi-electrodes array were performed in concrete specimens, which were cyclically exposed to pure water for six weeks, and to 3.5 % NaCl solution for additional 6 weeks. The initiation of corrosion was detected in the beginning of the wetting cycles and the retardation of corrosion at the end of drying cycles. It was also observed that corrosion was more localized in presence of chlorides since only one or two anodes were active during the wetting treatment. That was not the case with pure water treatment. After the exposure, the specimen was investigated with X-ray tomography and with scanning electron microscopy. The electrochemical and spectroscopic results were evaluated and compared.

LONG TERM MICROSTRUCTURAL EVOLUTION OF 9–12 %Cr STEEL GRADES FOR STEAM POWER GENERATION PLANTS

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The 9 % Cr steel grades were developed in the last 25 year in order to favourite the target of the improvement of the steam temperature and pressure necessary to increase the efficiency of the modern coal fired power plant for electricity production. Now a relevant experience in testing and service conditions has been generated and it is possible to produce consistent assessments of the mechanical and creep behaviours for long term application.
On the other hand the further trials to increase the Chromium content to improve the corrosion-oxidation behaviours of the 9 % Cr grades, despite the very promising short term properties, generate unpredicted premature failure after long term exposure. This failure was identified in the instability of the compositions with the appearance of Z-phase, with consequent drop down of the creep behaviours below their parent 9 % Cr grades.
This paper summarize the maturated knowledge in the field of the microstructural evolution of the 9–12 % Cr steels, as well as, the current status of development of these steel grades.

ELECTROLESS Ni-B-W COATINGS FOR IMPROVING HARDNESS, WEAR AND CORROSION RESISTANCE

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The present work deals with the formation of Ni-B-W coating on steel by electroless plating process and evaluation of their hardness, wear and corrosion resistance. The Ni-B-W coating was prepared using alkaline borohydride- reduced electroless nickel bath. Scanning electron microscopy (SEM) of the cross-sectional view of the electroless Ni-B-W coating was analyzed and layer characteristics was investigated. The hardness, wear resistance and corrosion resistance of electroless Ni-B-W coating were compared with electroless Ni-B coating. Both coatings were characterized using XRD. The study reveals that the Ni-B and Ni-B-W coatings are amorphous in their as-plated condition and upon heat treatment at 450 ^{0}C for 1 h, both Ni-B and Ni-B-W coatings crystallize and produce nickel and nickel borides in the respective coatings. Hardness of the coatings with and without heat treatments was compared. In both coatings, hardness increased with heat treatment. By wear resistant and wear coefficient analyses, pin-on-disc test was carried our by both coatings, before and after heat treatment. According to the analyses of the wear profile, in both coatings, wear resistance of the heat treated coatings increased. For investigating the corrosion characteristics of the layers, polarization tests (in 3,5% NaCl aqueous solutions) and immersion tests (in 10% H_2SO_4 and 5% HCl acidic solutions for seven days) were applied. According to these corrosion tests, Ni-B-W coatings posses noble anticorrosion properties compared with Ni-B coatings.

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BIOACTIVE ANATASE COATING ON Ti-ALLOY IMPLANTS

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Ti-based alloys are among the most common used for implants. However, titanium is considered as bioinert material, and as such it cannot form strong interfacial chemical bonding with bone , and in comparison with bioactive materials, its osseointegration rate is slow. Therefore some surface modification has to be applied if we want to improve osseointegeration. In our studies naturaly formed amorphous TiO_2 layer was transformed into crystalline by hydrothermal treatmnet. This firmly attached bioactive coating was tested both *in vitro* and *in vivo*.

Hydrothermal treatment in TiO_2 suspension with different addditives resulted in firmly attached (>45 MPa) crystalline TiO_2 coating, with signicantly lower wetting angle than that for the uncoated alloy. The coatings exhibited different anatase grain morphology, pinacoidal and elongated in (001) direction anatase crystals. Latter were prooved to be less bioactive due to the smaller (001) sufaces. The grain morphology also appeared to have important role for cell adhesion and proliferation. A major improvement of TiO_2 coated implants compared with uncoated was seen, on the other hand, for *in vivo* tests. Bone ingrowth for TiO_2 coated samples was much higher than for uncoated ones (44 % vs. 22 %), whereas the bone-to-implant contact was approximately the same (45 %). Mineralised bone was found through the whole thickness of porous Ti layer, even close to the Ti-alloy substrate and also in the smallest pores. Such properties were mainly ascribed to hydrophilic properties of anatase TiO_2 coating.

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CONCEIVING A NEW METALLURGY WITH OLD ALLOYS

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A number of alloys, known already for decades, were revisited in the years 1980-90, ending in a new comprehension of metallurgy. They basically contain aluminium and transition metals like iron and copper. They exhibit crystallographic properties identical to the ones of the icosahedron. This Platonic solid is a fascinating polyhedron because it is ruled by the Golden mean and as a consequence is invariant for any number of rotations by an integer number of a $2\pi/5$ angle around a line joining two of its opposite vertices. No solid crystal showed this property before the initial discovery of such an alloy in 1982, which has led its author to be awarded a Nobel Prize in Chemistry in 2011.

This property entails a number of consequences that mean that crystals equipped with this symmetry 1) cannot be solid crystals like the ones that do not show such a symmetry - they lack translational periodicity - and 2) that their properties are significantly different from those of "normal" crystals of nearby compositions. For instance, the icosahedral alloy of composition Al63Cu25Fe12 (in at. %) is almost a thermal insulator, despite it is composed of Al, Cu and Fe that are well known for their excellent thermal conductivity.

The author will try to take the audience to a brief tour in the new crystallography designed for understanding the structure of such new crystals. He will then depict how specific the properties of those alloys are. Examples such as low adhesion will be provided to illustrate the potential for applications of those alloys labelled nowadays Complex Metallic Alloys[1,2], or CMAs in short.

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DEVELOPMENT OF PRODUCTION OF ULTRAFINE-GRAINED TITANIUM IN CONFORM EQUIPMENT

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Ultrafine-grained titanium belongs to materials that possess high potential for medical applications and, thanks to its mechanical properties, it is already frequently employed in this field. The know-how for manufacturing ultrafine-grained titanium represents on of the most complex issues in titanium processing. The CONFORM process is one of techniques available for this purpose. The principle of the CONFORM technique is a continuous ECAP (Equal Channel Angular Pressing) process. At present, it is primarily used for processing of materials with low flow stress and good formability. This paper gives a description of this forming technique and of its applications in production of titanium semiproducts. Grade 4 purity titanium was used for the experimental programme. The factors explored in process trials included the impact of the shape of the exit chamber and of the temperatures at key locations within the CONFORM process on the resulting microstructure of the titanium product. Numerical simulations of the process were performed in DEFORM 3D software using various friction conditions. The friction coefficient of 0.7 was determined by means of a specially adapted pin-on-disc test. The actual flow of material was compared with the results of the simulation. Figure 1 shows a macrograph of the flow pattern of material in a critical location of the part. At present, the process offers reproducible continuous production of nanostructured titanium wires with 10 mm diameter.

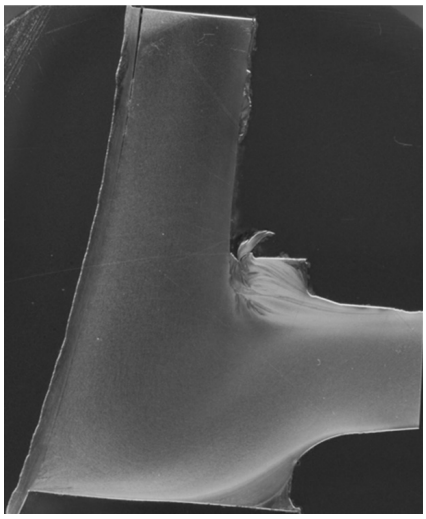

Fig. 1: Close-up view of flow patters in the part's critical location

THERMODYNAMIC ANALYSIS OF CAST IRONS SOLIDIFICATION WITH VARIOUS TYPES OF GRAPHITE

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The contribution summarises the results of oxygen activities measurements, which were measured and registered continuously in castings from cast irons with various type of graphite. The results were used to find the relationship between two variables: natural logarithm of oxygen activities and reverse value of thermodynamic temperature 1/*T* From obtained regression line the calculation of oxygen activities at different temperatures and calculations of Gibbs free energy ΔG at the different temperatures and calculation of single ΔG value for significant temperature the graphite crystallisation The results have been processed by a statistical analysis of data files for the different types of graphite with flake, vermicular and spheroidal graphite. Each material has its proper typical oxygen activities range and individual temperature function of Gibbs free energy for analysing and governing casting quality.
The contribution was worked out with the support by the Ministry of Industry and Trade in the framework of the project evidence No. FR-TI2/188.

FOAMING CHARACTERISTICS CONTROL VIA TUBULAR DIE LENGTH OF ALUMINUM FOAM

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Metallic foams have become a significant group of materials in several applications. Aluminum foams are produced by a powder metallurgical (PM) production process. On the process metallic melts are foamed by adding gas-releasing blowing agents which cause the formation of bubbles during in-situ decomposition. Firstly aluminum powders and blowing agent are mixed, secondly the mix is compacted and then the compact is foamed by melting. Experimental investigations are carried out in order to study the effects of different tube lengths. Cellular structure controllable close-celled aluminum foams can be produced through the tubular die length. 2D pore size distributions of the solidified foams were analyzed. The novel material can be designed in such applications in the automotive, aerospace, biomedical industries.

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ANALYSIS OF METAMATERIALS ON RADIO FREQUENCY ELECTROMAGNETIC FIELDS IN HUMAN HEAD AND HAND

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The split ring resonators (SRRs) structure consists of two concentric triangular rings of conductive material which exhibiting a resounding electric response at microwave frequency is employed. Both square rings have a gap, and each ring is placed opposite to the gap on the other ring. The size reduction is always possible in this kind of structures but one should be careful about the designed frequency. In this claimed a square type of metamaterial design, which is completely novel in the context of head and hand for specific absorption rate (SAR) reduction. One of the important reasons why this design was used in that more arrays are able to be placed within a given area. Mobile phones are relatively small, requiring small metamaterial designs. The square type of metamaterials yielded a better SAR reduction and antenna performances that were less strongly affected. The finite-difference time-domain method with lossy- Drude model is adopted in this analysis by using CST Microwave Studio®. The technique of SAR reduction is discussed, and the effects of attaching position, distance, and size of metamaterials on the specific absorption rate reduction are investigated. Furthermore, the impact of this existing material on the performance of the antenna was considered and compared in this study. The square type of metamaterials have achieved a 49.63 % reduction of the initial SAR value for the case of 1 gm SAR and 57.34 % reduction for the cases of 10 gm SAR. These results propose a guideline to choose square types of metamaterials with the maximum SAR reducing effect for a mobile phone.

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AUTOMATED DIAGNOSTICS OF DAMAGE OF ALUMINUM ALLOY UNDER CONDITIONS OF HIGH-CYCLE FATIGUE

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The analysis of loading conditions of modern civil aircrafts, the existing methods for evaluation of the accumulated fatigue damage, peculiarities of fatigue damage of aviation structural materials, results of previous fatigue investigations allowed formulating the approach to solving the problem of the quantitative evaluation of the accumulated fatigue damage of the aircraft structural elements. Cyclic loading forms the deformation relief on the surface of structural aluminum alloys, the intensity of which indicates the level of the accumulated fatigue damage. The relief of this type was observed both on standard specimens for fatigue tests in a broad range of loading conditions and on specimens prepared from the skin of the An-24 aircraft and tested under stresses close to the operational ones. The results of the investigations carried out using the methods of optical and electronic microscopy show the appropriateness of using the "deformation relief" term and applying it as a diagnostic parameter of fatigue damage. It is shown that cyclic loading on the surface of structural aluminum alloys causes the nucleation and development of the deformation relief, the intensity of which indicated the level of the accumulated fatigue damage. The quantitative parameter of damage in case of fatigue of the aluminum alloys is established, which is the saturation of surface with visual signs of the deformation relief. This parameter can be determined by the optical microscopy methods. The instrumental base and software were developed for the automated calculation of the damage parameter. The identification and quantitative analysis of the deformation relief of the aluminum alloy for the aircraft construction based on the processed digital images is performed. The behaviour of defects is assessed by the results of diagnostics of individual stages of the deformation process. It is established that the individual stages of the damage accumulation process are characterised by their own values of the integral image parameters. Based on the consecutive processing of the data on the surface cyclic deformation the main regularities in the propagation of defects are found. The theoretical preconditions are substantiated and the experimental results are obtained.

PEO COATINGS ON TI-BASED ALLOYS FOR MEDICAL APPLICATIONS: PRODUCTION AND CHARACTERIZATION

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To prolong the lifetime of an orthopaedic implant, an appropriate combination of surface physical and chemical properties is required to induce early osteoconduction and bone ingrowth on the surface of the implant material. There are various commercially-available surface modification technologies utilized to improve rapid osteoconduction and bone formation, including atmospheric plasma spraying, vacuum plasma spraying, anodization, grit blasting and acid etching.

This paper first explores the possibility of using Plasma Electrolytic Oxidation (PEO), also known as Micro-Arc Oxidation (MAO) or Anodic Spark Deposition (ASD), to produce textured TiO2 coatings of desirable roughness and chemistry on the surface of Ti-based alloys. PEO is a surface modification technique, wherein an alternating electrical current is applied to the substrates immersed in a dilute aqueous electrolyte to produce a thick oxide layer.

A pilot study was conducted to study the behaviour of human osteoblasts on the surfaces of uncoated commercial Ti6Al4V with two different diameters and surface roughnesses. This cell culture study was intended to provide a preliminary understanding of human osteoblast cell distribution and cell metabolic activity as a function of substrate disk size and roughness.

The results of x-ray diffraction phase analysis, scanning electron microscopy, energy dispersive x-ray spectrometry, and image analysis employed to investigate the chemistry and surface morphology variations of the PEO deposits will be discussed and related to the deposition parameters.

DETERMINATION OF SOLIDUS AND LIQUIDUS TEMPERATURES OF THE REAL STEEL GRADES BY DYNAMIC THERMAL ANALYSIS METHODS

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The better control of the entire steel production cycle – from selection of quality raw materials, through proper control of primary and secondary metallurgy processes, and finally, the optimum settings of casting and solidification conditions is necessary for modern competitive steel making company. In the refining processes, optimizing the slag regimes [1, 2], thermal and chemical homogenization of the melt [3] or filtration of steel [4] is very important to solve. In the casting and solidification of steel studies, works toward optimizing the process of solidification of heavy forging ingots [5] are currently being implemented.

Knowledge of solidus and liquidus temperatures of the studied steels is one of the most important factors – especially in dealing with the processes involved in the casting and solidification. These temperatures are critical parameters for proper adjustment of models (physical or numerical) or in the final stage of applied research of the real process. It is significantly affecting the final quality of the as-cast steel (billets or ingots).

Therefore, this paper is devoted to discussion of findings obtained during the utilization of dynamic thermal analysis methods to identify the solidus and liquidus temperatures for commercially produced steels.

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MANUFACTURING OF PRE-HARDENED VERY CLEAN TOOL STEEL

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The last decades have seen a rapid development in clean steel manufacturing. Together with the improvements in hard-machining this give steel producers possibilities to design and manufacture very clean steel. This has led into a development of a family of new pre-hardened tool steels utilizing continuous casters, equipped with soft reduction, pertaining to control and minimize the segregation levels.

Such steels, being dimensional stable in machining also enables higher cutting speeds when compared with traditional tool steel of equivalent hardness. Mould and die making is thereby simplified and can be made at reduced lead times and costs.

Use of effective heat treatment facilities also enables the steel producer to choose lean chemical compositions for the aimed hardness levels. The new chemical compositions give benefits such as enhanced ductility, high thermal conductivity and improved machinability. Furthermore, such new steels are suitable for surface engineering to tailor-make desired mould surface properties.

FOAMS OF HEAT TREATABLE ALUMINIUM ALLOYS

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An effect of aluminium alloy on mechanical properties of cellular structure was studied. Foamable precursors of heat treatable alloys AlMgSi0.6 and AlMg2.5Zn6Cu2 were prepared through the powder metallurgy route with addition 0.4 wt% TiH_2 as foaming agent. Within this study, the expansion ability, the effect of T6 heat treatment with regard to hardness and compression strength of the cellular structure and micro- and macrostructural analysis was observed. Experiments on expandometer showed differences in foaming kinetics of the studied alloys. However, the maximal expansion height was comparable for both alloys. The cellular structure of the as-foamed samples was subsequently analyzed by RTG-tomography. The micro-hardness measurement on the samples before and after the heat treatment confirmed a significant hardness increase of the heat-treated samples. Subsequent uniaxial compression tests on the heat-treated foamed samples also showed increase of the compression strength values as well as differences in the deformation behavior compared to the untreated samples within the whole deformation process.

ACCELERATED CARBIDE SPHEROIDISATION AND REFINEMENT (ASR) OF C45 STEEL DURING INDUCTION HEATING

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Accelerated spheroidisation of carbides in medium carbon steels is a highly desirable phenomenon from the manufacturing viewpoint for several reasons. It allows rapid softening to be achieved, and therefore generates considerable savings in comparison with conventional annealing that requires several hours to complete. Moreover, when combined with ferrite grain refinement, rapid spheroidising may improve toughness, plasticity properties and yield and ultimate strengths of materials. Thanks to the ASR process (Accelerated Carbide Spheroidisation and Refinement), the desired mechanical properties can be achieved without the need for alloying or even hardening, and without the associated costs.

In this study, the heat treating cycle was carried out using induction heating, which offers high heating rates. The process consists of rapid heating of the feedstock to austenitizing temperature, a short hold, cooling down and rapid cycling around the transformation temperature A_{c1}. Within a short interval of time: on the order of no more than several minutes, this cycle produces the microstructure of fine ferrite grain with globular carbides. This paper describes optimisation of the ASR process parameters, namely the feedstock heating rate and the processing temperature, and the resulting mechanical properties and microstructure of the C45 steel. This method is suitable for continuous processing of long and relatively thin feedstocks in inductors and cooling sections. A continuous process improves the production flexibility, as the amount of the material to be processed does not depend on the furnace capacity.

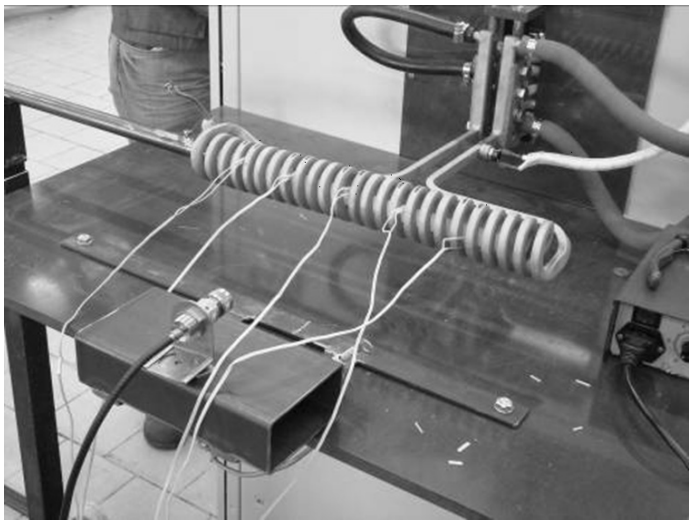

Fig. 1: Induction heat treating of C45 steel

ADHESION OF ESCHERICHIA COLI TO AUSTENITIC STAINLESS STEEL (AISI 316L) WITH DIFFERENT SURFACE FINISHES

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Stainless steel is most commonly used in industrial, chemical, medical and food processing applications. Adhesion of bacteria on stainless steel enhances the material corrosion and presents a chronic source of microbial contamination. The aim of our research is to examine the effect of different surface finishes of austenitic stainless steel on the adhesion of Escherichia coli. Surface morphology of the samples was analysed by atomic force microscope (AFM), scanning electron microscope (SEM) and contact angle goniometer. Different surface finishes of stainless steel correspond to different roughness values (Ra) ranging from 400 nm - 2 nm. Contact angle measurements and surface free energy calculations show that all surface finishes of stainless steel have similar contact angles and surface free energy. Bacterial adhesion on stainless steel disks was examined by SEM. Free software ImageJ was used for quantification of adhered cells. Escherichia coli was found to adhere to all stainless steel finishes. On rougher samples with furrows, cracks and scratches the bacteria prefer these surface irregularities over smooth surface, as they provide shelter from unfavourable environmental factors. The pattern of bacterial adhesion follows these surface irregularities (Fig. 1a). Bacteria also show tendency to clump together and to form clusters (Fig. 1b).

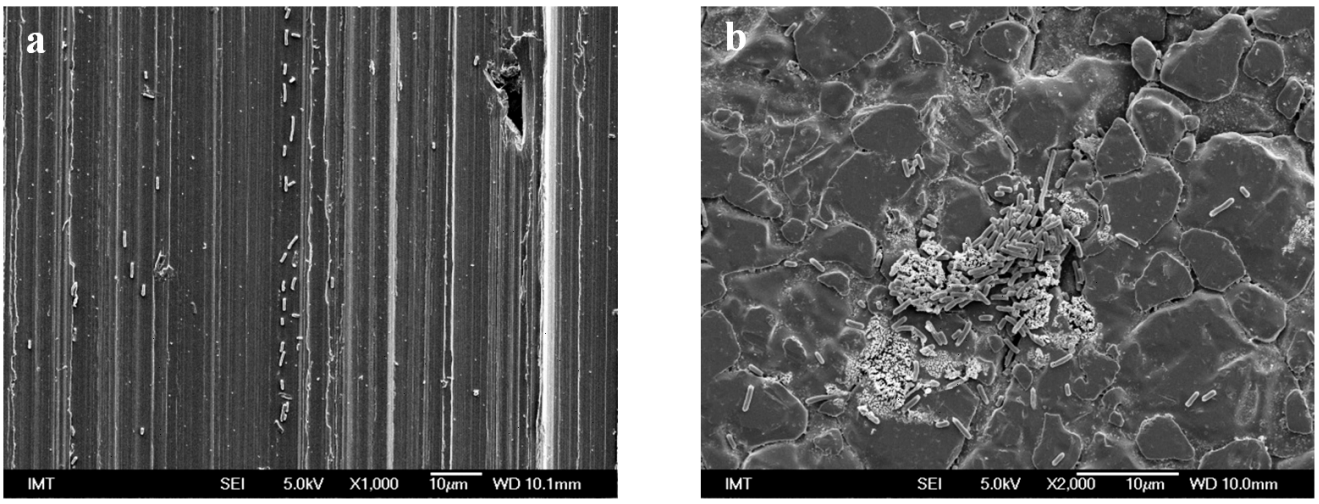

Figure 1. SEM image of attached Escherichia coli to stainless steel sample A100 (a) and Aizv (b).

CUTTING AND FORMING TOOL MATERIALS - PROPERTIES AND TRENDS IN THEIR DEVELOPMENT

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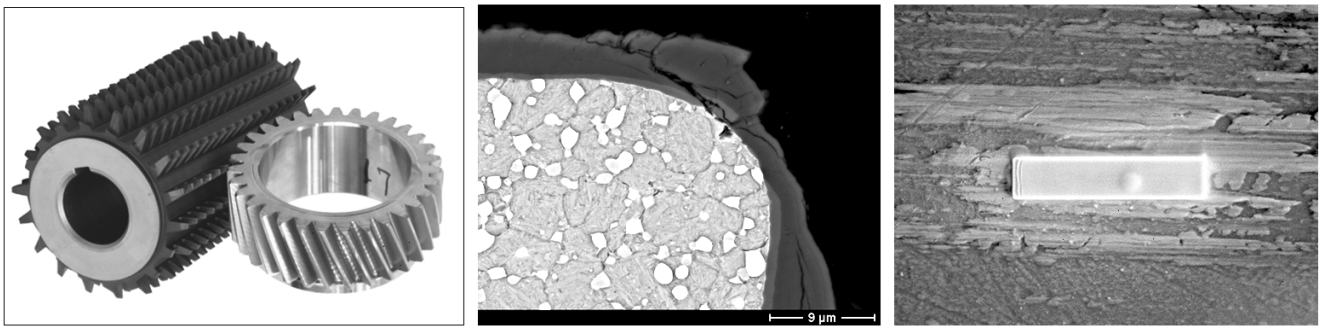
Tools are generally used to handle and treat other materials. This talk is restricted to industrial tools for cutting and forming of metallic objects. To be effective and last long tool materials need to possess a combination of high thermal, chemical, mechanical and wear resistance. Since each tooling operation requires an optimised combination of these properties, the number of different tool materials is very high.

An introduction is given to the metallurgical possibilities for strengthening of metallic materials with special emphasis on tool steel [1-3]. In parallel to the classification of tools from their areas of application, a summary is given on how to tailor tool materials to meet critical demands, and a number of selected examples will be presented.Forming tools for cold operations are optimised for wear resistance and fatigue strength. They are primarily strengthened by hard-phase particles (carbides). Tools for hot working applications are primarily optimised to maintain a high yield stress and fatigue resistance at elevated temperatures. They are relatively low alloyed and preferably contain small sized grains and particles. The latter is to avoid cracking due to thermal cycling. High speed steel (HSS) combines the properties of wear and thermal resistance displayed by cold working and hot working forming tools, respectively. Both HSS and hot work tool steel are today usually made from powder in order to get a homogeneous composition and small sized grains and particles. Most often, edge wear limits the life of cutting tools, where as work material adhesion (galling) usually limits forming tool life. Both factors deteriorate the quality of the product. An example of a gear hob (milling cutter) made of HSS is given in Fig. 1a and b [4]. The importance of proper edge preparation prior to and after coating will be emphasized. One major concern about forming tools is their galling resistance, i.e. their ability to avoid picking up work material, cp. Fig. 1c. Alloying with N, polishing, and coating are three means to improve galling resistance.



a) b) c)

Fig. 1. a) A TiCN-coated HSS gear cutter (left). b) Cross-section of TiN-coated gear cutting tooth edge. Note the poor coating quality at the edge [4]. c) Austenitic stainless steel adhered to forming tool steel. Platinum (the white rectangular) protects an area to be cross-sectioned and subsequently studied by TEM to investigate the interface between tool surface and adhered work material [5].

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ALL THREE NATURALLY EXISTING TiO_2 CRYSTALS SYNTHESIZED SOLVOTHERMALLY

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The crystal modification, morphology, size of TiO_2 crystals have been studied using a transmission electron microscope (TEM), field emission gun scanning electron microscope (FEG-SEM), scanning electron microscope (SEM) and x-ray powder diffraction (XRD).
The material was prepared by solvothermal synthesis from suspension of amorphous TiO_2 (source of Ti ions was Ti (IV) isopropoxide) in different solvents (distilled water, ethanol, 2-propanol, glycerol etc.) at 180 °C for 12 h. After solvothermal synthesis autoclave was let to cool down to room temperature spontaneously.
The crystal modification, morphology and size highly depended on the solvent. We produced all crystal modifications of TiO_2 which are present in nature i.e. from micro-seized hedgehog-like rutile crystals (see Figure 1a) to nano-sized anatase crystals of pre-bipyramidal shape with small amount of brookite (see Figure 1b, [1]).

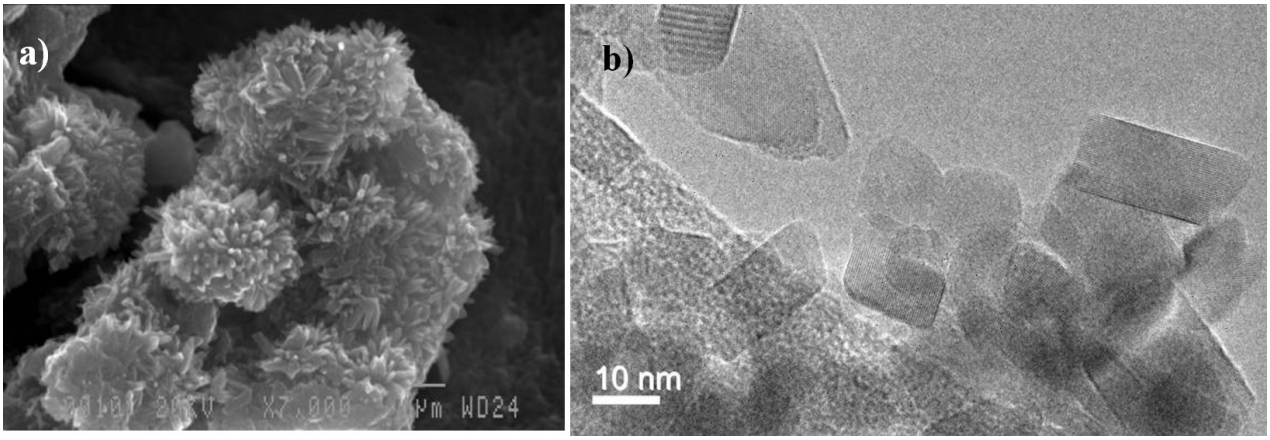

Figure 1. a) FEG-SEM micrograph of TiO_2 prepared in glycerol. b) HRTEM micrograph of TiO_2 prepared in distilled water.

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NANOCOMPOSITES OF PHENOLIC RESIN/MONTMORILLONITE PREPARED BY ONE STEP IN SITU INTERCALATIVE POLYMERIZATION

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Polymer nanocomposites with clay mineral montmorillonite (MMT) have been the subject of extensive research for 20 years. However, phenolic resin/clay nanocomposites have not been studied much, especially when compared to poliamide/MMT or epoxy/MMT nanocomposites. As most of other polymer/MMT nanocomposites, the phenolic resin nanocomposites were prepared by melt intercalation, solution intercalation or intercalative polymerization in the presence of modified MMT. One step in situ intercalative polymerization which involves simultaneous modification of MMT with ammonium salts, polymerization and polymer intercalation has been successfully used to produce intercalated PMMA/MMT[1] as well as novolac nanocomposites.[2]

One step in situ intercalative polymerization has now been applied to produce phenolic resin/MMT nanocomposites. Both, resol and novolac type of nanocomposites were prepared. Phenol, formalin, catalyst, quaternary ammonium salt (QAS) and Na-MMT were mixed and heated at reflux for 4 hours. Nanocomposites were precipitated by cooling, than dried and analysed by XRD, DSC and TGA. Two types of QAS were used: (a) with one long alkyl chain (cetyl-trimethylammonium bromide – CTM) and (b) with three medium sized alkyl chains (tricaprylyl methylamonium chloride – TC). Better intercalation was observed in nanocomposites with CTM, which is exhibited in bigger interlayer spacing determined by XRD. The presence of MMT influences the structure of novolac resin and decreases glass transition temperature.

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FABRICATION OF SiC_f/SiC COMPOSITES BY SITE-P PROCESS

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Continuous SiC-fiber-reinforced SiC composite (SiC_f/SiC) is an attractive candidate structural material for advanced concepts of fusion power plants. The main advantages over other fusion relevant structural materials lies in its intrinsic properties of high temperature and chemical stability, low neutron activation and afterheat levels and the fact that it is the only non-magnetic material proposed. Fabrication of such composites is a very challenging task due to limitations and requirements set for such material.

Novel fabrication route (SITE-P) based on combination of electrophoretic infiltration (EPI), followed by densification with polymer infiltration and pyrolysis process (PIP) was introduced for fabrication of SiC_f/SiC composites. In the first step the fabric preform is infiltrated with SiC powder in an aqueous suspension using electrophoretic deposition, which enables high packing densities of infiltrated matrix. In the second step the "green" composite is infiltrated by a pre-ceramic polymer and heat treated to obtain a crystalline ceramic. Samples densified by SITE-P process consist of predominantly crystalline β-SiC with ~87 % theoretical density. Homogeneous microstructure and favourable porosity and grain size in comparison to other techniques are achieved. Fabricated composite material exhibits relatively high thermal conductivity (~60 W/mK) in comparison to other state-of-art materials.

TEM AND STEM INVESTIGATION OF NiTi SHAPE MEMORY ALLOY TREATED IN OXYGEN PLASMA

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NiTi-based alloys are considered to be one of the most important shape memory alloys (SMA) in variety of industrial and medical applications because of their excellent mechanical properties, super elasticity, high chemical corrosion resistance and good biocompatibility. NiTi alloys could be successfully used if the surface of materials is properly treated, in order to block the release of Ni into the human body. One method is the coating of NiTi alloys with a thin film of protective material. The materials used for coating are the oxides of Ti or its nitrides. The oxides of Ti are also biocompatible materials with a high corrosion resistance.

NiTi shape memory alloy was treated in oxygen plasma for 10 s and 17 s. Thin foil cross-section specimens of plasma treated NiTi were prepared by means of argon ion-slicing Ion Slicer (Jeol EM-09100IS) and further analyzed by means of transmission electron microscopy (Jeol JEM-2100) at 200 kV using conventional transmission electron microscopy (CTEM), high-resolution TEM (HRTEM), energy dispersive X-ray spectroscopy (EDS, Jeol JED-2300 Series), electron diffraction and scanning transmission electron microscopy (STEM, Jeol EM-24511SIOD) with bright-field (BF) detector, and EDS mapping.

In this study, NiTi shape memory alloy internal structure was examined. Detailed characterization of the microstructure was performed for the analysis of the phases. At least two layers with different ratios of titanium and oxygen or titanium, nickel and oxygen or titanium and nickel appeared at the interface oxygen-NiTi. The thickness of both the layers was around 150 nm for the specimen treated in oxygen plasma for 10 s and around 670 nm for the specimen treated 17 s (Figure 1).

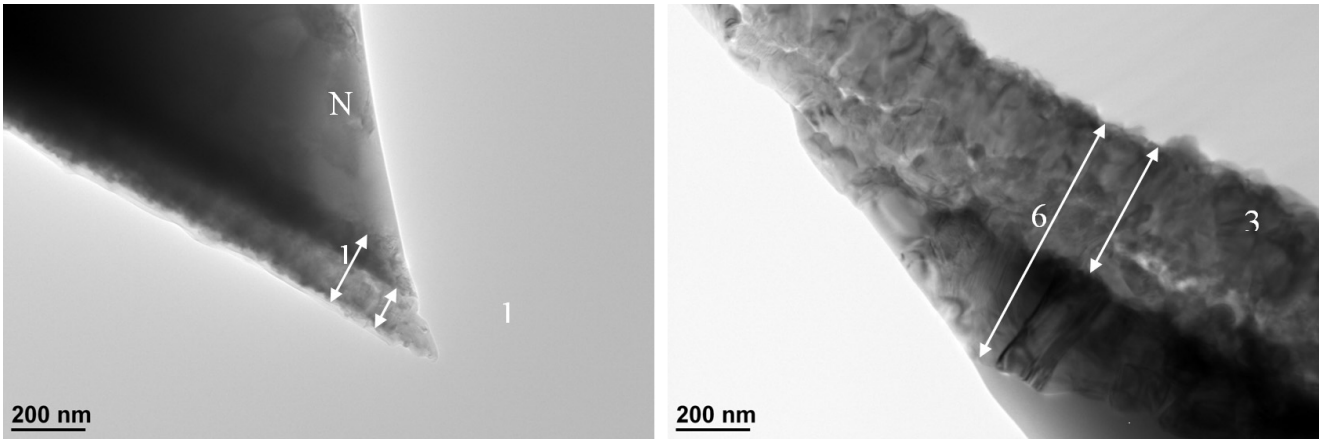

Figure 1: TEM images of NiTi alloy treated in oxygen plasma: for 10 s (a) and 17 s (b).

STUDY OF SURFACE TREATED NiTi SMA MICROSTRUCTURE

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NiTi alloy of approximately equal Ni and Ti atomic concentrations (NITINOL) have unique mechanical properties, shape memory and super elasticity, durability and biocompatibility. Of particular interest is the role SMAs may play in biomedical implants, as a number of useful items have already been produced, including orthodontic implants, stents orthopaedic staples and even occluding structures to heal congenital heart defects [1,2]. While alternatives to many of these items existed in some form prior to the use of SMAs, the thermo-elastic transition of the SME has allowed for significant improvements. Medical applications are still hindered by the concern for the release of Ni into surrounding tissues. Concerns have been raised about the composition of Nitinol, specifically with the presence of nickel, a known allergenic carcinogen that exhibits one of the highest sensitivities in metallic allergen tests [3,4].

Results of our previous research showed that the surface of a melt spun NiTi shape memory alloy was covered with a thin oxide film. The thickness of the native oxide film was about 10 nm. After experiments on biocompatibility the oxide film thickness increased to about 20 nm. The oxide film before and after the biocompatibility tests consisted of titanium oxide and near the surface inhomoheniously distributed metallic Ni nano grains.

In order to improve the biocompability and to prevent Ni release, the material has been exposed to fully dissociated oxygen plasma and characterized by field emission Auger electron spectroscopy (AES) depth profiling and X-ray photoelectron spectroscopy depth profiling (XPS). The AES depth profiling showed that the oxide thickness increased monotonously with increasing oxygen plasma treatment time. After treatment for 1.3 s, 3 s, 5 s, 10 s, and 17 s, the oxide film was estimated from 4 nm to 900 nm. In all cases the oxide film contained predominantly titanium oxide, with several vol.% of nickel oxide still persisting near the surface.

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ENERGY AND TIME SAVING LOW TEMPERATURE THERMOMECHANICAL TREATMENT OF LOW CARBON PLAIN STEEL

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Reducing the energy demand is one way of cutting the cost of finished steel products. Items for heat treatment require high expenses as well. This paper presents a method of time reduction using soft annealing, which is used for ferrite-pearlite steel to improve especially its cold formability. One of the key phenomena of the process is the change of the pearlite morphology, which is transformed from lamellar to globular. The conventional soft annealing is characterized by a long processing time. One way to reduce the time during cementite spheroidization is a special process of low temperature thermomechanical treatment.

An experimental programme was carried out on low carbon plain RSt-32 steel. During the programme not only the influence of deformation below A_{C1} temperature on grain refinement and carbide spheroidisation, but also the influence of temperature cycling around A_{C1} temperature at variously wide temperature intervals was investigated. Attention was also given to the influence of the holding time between individual deformation steps and furthermore to deformation heat resulting from deformation. This treatment is called ASR (acceleration spheroidization and refinement).

By gradual optimisation of the thermomechanical treatment process the original lamellar pearlite morphology was changed into a recrystallized structure with fine ferrite grain with a size of about 3 μm and fine spheroidized cementite. The final hardness values were about 150 HV10. This represents a decrease of hardness of about 25% in comparison to the original lamellar ferrite-pearlite structure. Moreover, significant time and energy savings will be reached, because the treatment shortens the thermomechanical exposure from several hours to several minutes.

DEPENDENCE OF CREEP RATE ON MICROSTRUCTURAL CHANGES IN WELDS OF MARTENSITIC 9-12% Cr STEELS

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Two martensitic 9–12% Cr steels, X20CrMoV121 and P91, have been considered for this research work. Creep tests were performed on two different regions of welded joints and on parent steels, the microstructure of which was changed through tempering up to 2 years at 650 °C and 1 year at 750 °C, and certain shorter discrete tempering durations. SEM imaging was carried out at appropriate magnification in order to analyze the changes of microstructure after the mentioned tempering. Image analysis was conducted with the aim to find the correlation between microstructure features, such as the size of precipitates, their distribution and mutual distance, changes of these features due to the tempering, etc., with the measured creep rate.

AA413.0 AND AA1050 JOINED WITH FRICTION STIR WELDING

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Friction stir welding (FSW) technology has been growing since it was patented in 1991 at TWI. Since then the majority of research and industrial applications for joining aluminium alloys were made on wrought aluminium alloys. Lately several investigations are done in FSW of dissimilar alloys. FSW also has big potential in casting industry – especially in high pressure die casting (HPDC). Due to in this article investigation of FSW dissimilar joint made from casting aluminium alloy (AA413.0) and technical pure aluminium (AA1050) was done. This kind of joint can be used to make assembled casting, joined with FSW with aim to have casting with different material properties or to join HPDC with FSW to assemble casting with inner cavities.

In this article the temperature distribution of FSW joint of a cast aluminum alloy and pure technical aluminum is investigated. In the experimental work we were changing several FSW parameters: tool speed, tool rotation, position of tool regarding the joint center. During joining the temperature was measured with thermocouple and the temperature distribution in steady state was calculated with FEM program Sysweld. Microstructure and mechanical properties of the joint was investigated.

TRIBO-CORROSION DEGRADATION OF PROTECTIVE COATINGS ON STAINLESS STEEL

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Wear, erosion, corrosion and other forms of material deterioration lead to significant decrease of performance and thus increase the production cost. Different PVD-protective coatings have been developed in order to reduce these problems. Further progress in this field, however, depends on the understandings of the surface and interface effects, especially in the case of tribo-corrosion when degradation of materials results from a combination of tribological and electrochemical processes.
This work will focus on the methodology that allows one to conduct sliding wear and corrosion tests simultaneously and to follow in situ the degradation process of the coating systems by controlling (in real time) the friction coefficient, corrosion current and corrosion potential. In combination with electrochemical impedance spectroscopy and modeling using equivalents circuits, this approach can be then applied for detailed analysis of the degradation mechanism related coating/substrate interfaces. Using practical examples from the area of biomedical applications; i.e. the stainless steel 316L substrate and stainless steel substrate protected with TiAgN and TiSiN hard coatings, it will be shown that tribo-corrosion experiments can be used to design and predict the properties of new coatings with enhanced performance and stability.

CHALLENGES AND ADVANTAGES OF RECYCLING WROUGHT ALUMINIUM ALLOYS FROM LOWER GRADES OF METALLURGICAL CLEAN SCRAP

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Looking to the future, production of recycled aluminium of standard quality from the cheapest sources will play an increasingly significant role in the growth of the European aluminium industry. Regarding recycling of wrought aluminium alloys from lower grades of scrap (metallurgically clean but highly contaminated with non-metallic impurities), the following two tasks were identified as the most demanding: (i) achieving the required final chemical composition of the alloy with minimal addition of primary aluminium and alloying elements; and (ii) keeping the level of impurities (inclusions, hydrogen, trace elements and alkali metals) in the molten metal below the critical level. Because of the lack of chemically-based refining processes for reducing the concentration of alloying and trace elements in molten aluminium, once concentrations of these constituents in the melt exceed the corresponding concentration limits, the only practical solution for their reduction would be appropriate dilution by primary metal. To avoid that costly correction, carefully predicting and assuring the chemical composition of the batch in the pre-melting stage of casting should be applied. Fortunately, some of the impurities like hydrogen and alkali metals, as well as various (mostly exogeneous) inclusions, could be successfully reduced by existing refining procedures.
In this work, (i) the state of the art technologies, including some emerging technical topics such as the evolution of wrought alloys toward scrap intensive compositions, monitoring of the content of organics in incoming scrap and the quality of molten metal achieved by different smelting and refining technologies, and (ii) the relevant economic advantages of the recycling of wrought aluminium alloys from lower grades of scrap are reported. By analyzing the market prices of various grades of scrap and the total cost of their recycling, the cost of aluminium ingots made from recycled aluminium was modelled as a function of aluminium and alloying elements content in the incoming scrap. Furthermore, scrap mixtures for producing aluminium wrought alloys of standard quality from lower grades of scrap and with significant new added value were illustrated.

TOPMOST STEEL PRODUCTION DESIGN BY USING ARTIFICIAL NEURAL NETWORK THROUGH PROCESS MODELING

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Artificial neural networks (ANNs) have been used in this work as an alternative to physics based numerical modeling [1-2] for computing the final mechanical properties of steel semi products. Production of steel bars for application in forging, spring and engineering industries in Štore Steel company has been used as a demonstration of this new methodology, for the first time applied in the through process modeling of steel [3-5]. The complete process path consists of six processes: melting of steel, continuous casting of steel, hydrogen removal, reheating, rolling and finally cooling on cooling bed. Two open source ANN libraries have been used (Aforge and NeuroDotNet). Both libraries contain neural computing elements that have the ability to respond to input stimuli and to learn to adapt to the environment [6]. The process path is completely defined by 123 process parameters. The approximation model was built on the basis of 34 process parameters that turn to be influential and also vary over the data used. Five output values were observed: elongation, tensile strength, yield stress, hardness after rolling and necking. The results obtained in parametric studies based on the ANN based model seem consistent with expectations based on industrial experiences. However, further improvements in data acquisition and analytical procedures are envisaged in order to obtain a reliable enough methodology for use in the everyday industrial practice.

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MICROPATTERNING VIA LASER DIRECT IMAGING (LDI)

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Micropatterning is miniaturization of periodic structures on the surface. The application of micropatterning is rapidly increasing in engineering[1,2], biomaterials engineering[3], cellular biology[4,5], biomedicine[6], opto-electronics[7] and other fields.

Most traditional method for micropatterning and microstructuring is photolithography which is basis for today's computer microchip production. Similar is soft lithography which is a class of techniques using elastomeric materials, which is chipper for mass production and especially convenient for biomedical applications. In order to find cheaper faster and more accurate methods a number of techniques have been investigated like, direct-write laser (X-ray, ion beam, e-beam) lithography, nanoimprint lithography, drying/evaporative lithography, self-assembly methods, aerosols micropatterning and others.

One of the alternative methods is Laser Direct Imaging (LDI), a technique where a laser beam is used to image a pattern directly on photoresist-coated surface and thus avoids photomask fabrication. The most obvious difference from the traditional photolithography is the benefit of time and cost savings associated with the creation, use, handling and storage of photo tools. Further, this method avoids problems related to mask related defects.

The novel LPKF developed ProtoLaser LDI system has a superior 1 μm laser spot size which allows for very small structure resolution. Implementation of acusto-optic deflector allows for extremely fast and accurate writing with positioning accuracy bellow 1 nm.

We present several patterns on micron and sub-micron scale for antibiofouling and microfluidics applications created by this novel LPKF LDI system.

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POLYHYDROXYALKANOATES: BIODEGRADABLE POLYMERIC MATERIALS FROM RENEWABLE RESOURCES

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Polyhydroxyalkanoates (PHAs) attract attention as sustainable "green plastics"; they feature the potential to replace their petrol-based competitors in several segments of the plastic market in the foreseeable future. To reach this goal, such "green plastics" must compete with established petrol-based plastics in economic terms. Up to date, PHA production starts from prized substrates of high nutritional value like sucrose, starch or vegetable oils. As an outdoor, carbon-rich industrial waste can be applied as feedstock; this makes PHAs economically competitive without interfering with human nutrition or animal feeding.

The location decision for PHA production facilities depends on the preferable in-house availability of such waste streams. For competitive PHA production in Europe, the ANIMPOL and the WHEYPOL process transform local waste available at sufficient quantities. In the ANIMPOL case, waste lipids from slaughterhouses are converted to glycerol and a mixture of saturated and unsaturated biodiesel (FAEs). Saturated FAEs, with $5 \cdot 10^4$ t p.a. in Europe, decrease biodiesel performance as engine fuel, but can be metabolized to PHA. Further, $1.4 \cdot 10^8$ t p.a. of whey from dairies causes environmental concern. Lactose, whey's main carbohydrate, acts as substrate in bioprocesses like WHEYPOL. These strategies demonstrate the feasibility of making "green plastics" competitive by integrating their manufacturing into existing production lines, where convertible waste streams directly accrue.

BIOMASS ASH CHARACTERIZATION AND ITS USE IN CEMENT-BASED MATERIALS

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This paper presents possibilities of use Slovenian ash from co-buring biomass by replacing a Portland-slag cement CEM II/A-S 42,5 R with the equivalent mass of 5, 10 and 15 wt.% of biomass ash. The physical properties and chemical composition of fresh and storage biomass ashes were tested. Characterization of the biomass ashes samples was also conducted by means of X-ray diffraction (XRD) and scanning electron microscopy (SEM). The research pastes were prepared and mechanically, physically and mineralogical characterized. Results showed that fresh biomass ash is less appropriate then altered ash for production of stable mortars, due to high quantity of free CaO. In cement based pastes with higher amount of added biomass ash the mechanical properties decrease after 28 days, than at the pastes with lower amount of biomass ash.

A TOP-DOWN APPROACH FOR PREPARATION OF SODIUM NIOBATE NANOPOWDERS

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Sodium nioabte ($NaNbO_3$) is a representative of lead-free ferroic materials. It exhibits a complicated phase transition behavior including different antiferroelectric and ferroelectric phases [1]. Beside the temperature and electric-field induced phase transitions, size-induced phase transition phenomena have been recently observed [2,3]. In order to investigate the effect of the particle/grain sizes on the polymorphism, and consequently on the functional properties, dense $NaNbO_3$ ceramics with a wide grain size range should be prepared. A necessary condition for the preparation of ultrafine-grained ceramics is the $NaNbO_3$ nanopowder.

In this work we present a simple and effective processing route for the preparation of $NaNbO_3$ nanopowder by combining conventional and well established ceramic processing techniques, such as the solid-state synthesis of submicron sized powder (Figure 1a) and subsequent comminution to nano-range in an agitator bead mill (Figure 1b). The milling process was optimized to yield nanoparticles with the average size of around 25 nm, which is comparable to the particle sizes obtained by solution-based chemical routes or mechanochemical synthesis. The proposed approach does not require any expensive reactants and, as it is easily up-scaled, it could yield large quantities of the $NaNbO_3$ nanopowder. The compaction behaviour of the nanopowder was investigated in order to establish a suitable starting point for further research of the sintering process.

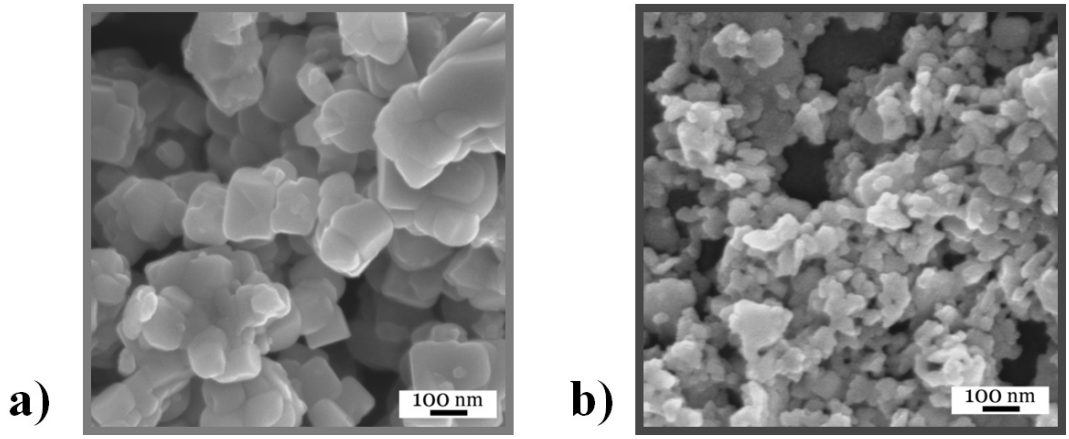

Figure 1. FE-SEM images of the solid-state synthesized submicron sized powder (a) and the nanopowder, prepared by bead milling (b).

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STAINLESS STEELS: WHAT NEW MARKETS CAN BE DEVELOPED IN THE YEARS AHEAD?

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After decades of dynamic development, many classic market segments for stainless steel applications like domestic appliances are now approaching saturation.. Stainless steel producers are therefore trying to develop new end-use markets. Several examples of new fields of applications will be presented. Stainless steels have found their place in the production of alternative energy sources, such as the solar facade panels, absorbtion plates of conventional solar cells, the production of biogas and in latest development of nuclear fusion. They have been present in building and construction since their invention, however innovative use, environmental and sustainability criteria are changing the rules in material selection. The attractiveness of materials is even further increased with new surface finishes being available, like coloured stainless steels or 3D finishes. In the field of health and environment stainless steels are indispensable. New opportunities are opening up in particular in the preparation, storage and distribution of drinking water, in wastewater treatment, the pharmaceutical and food processing industries. Transport is another area that presents new possibilities for stainless steels, both in the production of buses, metros and trains, as in the construction of stations and airports. Stainless steels will continue to be the material of choice also in the new fields of development.

MICROSTRUCTURAL AND STRUCTURAL STUDIES OF THE $(ZnO)_x$ In_2O_3 SYSTEM FOR THERMOELECTRIC APPLICATIONS

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Thermoelectric materials have a great potential for the harvesting of waste heat and its effective conversion into electrical energy. As an n-type thermoelectric material the ZnO-based ceramics showed relatively good characteristics, especially when doped with In_2O_3 [1, 2].

The main goal of this research was to assess the influence of the amount of added dopant on the microstructure of the ceramics and the formation of the structural defects. We studied the samples in the homologous series $(ZnO)_xIn_2O_3$ for x = 5, 7, 9, 11, 13, 15, 18, 25, 30 and 36. Powder mixtures of ZnO and In_2O_3 in the proper molar ratio were homogenized and pressed into pellets by uniaxial and cold isotactic pressing. The TG/DSC analyses of the samples up to 1350°C were performed to study their thermal behavior with respect to the composition. The sintering characteristics were analyzed up to 1400°C using a heating-stage microscope. According to these analyses, the reaction is occurring at around 1150°C. The samples were sintered in air in the temperature range from 900°C to 1400°C, from 2 hours up to several days. The microstructures of the un-etched and thermally etched samples were examined using a scanning electron microscope (SEM) equipped with an energy-dispersive x-ray spectrometer (EDXS) for the compositional analysis. The structural characteristics of the samples were analyzed using a high-resolution transmission electron microscope (HRTEM). The modulated structure with two types of defects (planar and zig-zag) was observed. According to the preliminary results, composition and sintering time have a large influence on the ordering of the planar defects, and could significantly affect the thermal and electrical conductivity of the ZnO-In_2O_3 ceramics. The microstructural and structural characteristics of the samples in the $(ZnO)_xIn_2O_3$ system will be discussed with regard to the influence of the composition and firing temperature on the phase composition, grain morphology, and formation and ordering of the structural defects.

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MODEL OF LADLE NOZZLE OPENING BASED ON GENETIC PROGRAMMING

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Štore Steel Ltd. faces a huge problem with ladle nozzle opening during the production of a wide variety of steel grades. After the ladle treatment the steel melt is poured from the ladle through the sliding gate and the nozzle into the tundish on the continuous casting machine. Due to often cloggings the ladle nozzle must be opened with the oxygen which can cause melt pollution. The purpose of this paper is to present the attempt for reducing ladle nozzle openings. In this attempt genetic programming method was used. The experimental data on 115 consequently casted heats was used. The steelmaking technology, number of heats in the sequence, ladle treatment time, inner and outer ladle nozzle wear, ladle number, ladle wear, operator number and melt chemical composition (Al, C, Mn and Si) were taken into account for the prediction of ladle nozzle opening. The best genetically developed model for ladle nozzle opening prediction correctly predicts 107 out of 115 situations of opening the ladle. The results of the genetic programming based modeling have been used in practice for the changing of several steelmaking technologies.

CONVERSION OF MS 70 ALPHA BRASS TORSION TEST DATA INTO HOT FORMING PROCESSING MAPS

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The paper presents a summary of research into plasticity under hot forming conditions that was carried out using SETARAM-Vítkovice torsion plastometer. The experimental material was the Czech Standard Ms70 deep-drawing cartridge brass. Specimens were cut from hot-extruded and subsequently cold-drawn brass bars.

Formability tests were performed on 6 mm dia specimens at 650, 700, 750, 800 and 850 °C and at the speeds of 16, 80, 400 and 800 rev·min^{-1}. These testing conditions are equivalent to the conditions of ordinary industrial hot extrusion of brass: the single most problematic operation in the manufacturing process in terms of occurrence of serious defects.

Results of torsion tests were converted into the conventional format comprising maximum flow stress levels in dependence on the peak strain intensity level. The points thus obtained can be used for finding the activation energy for forming Q, which is useful for determining the thermally-compensated strain rate with the aid of the Zener-Hollomon Z parameter.

Energy dissipation maps with axes showing deformation temperature and logarithmic strain rate were computed using a dynamic material model. An example for a constant strain level of $e = 0.3$ is shown in Fig. 1. The paper includes a discussion of changes in the processing maps at higher strains and optimum regions for hot extrusion of brass.

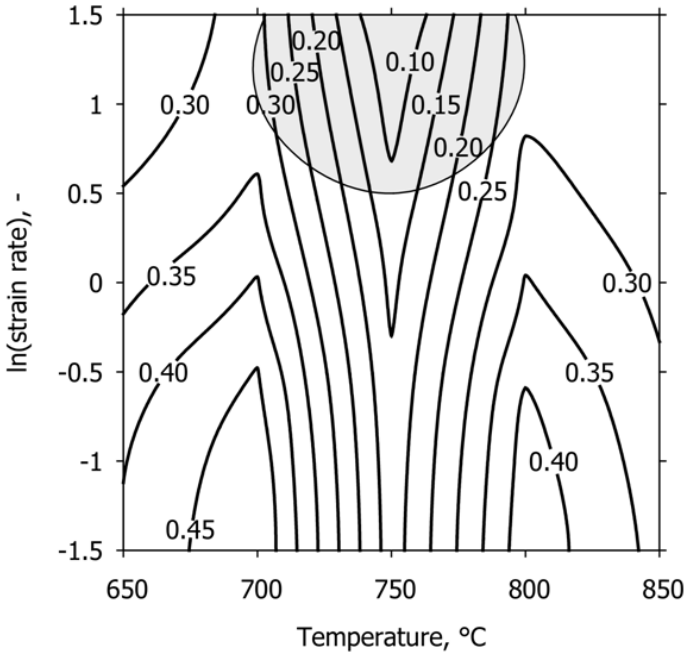

Fig. 1 Processing map for Ms 70 brass for the true strain of $e = 0.3$

COMPUTATIONAL MODEL OF SANDWICH BEAM WITH PIEZOELECTRIC PATCHES

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The presented work is focused on modelling of piezoelectric materials which are used as primary components of transducers in smart structures. The "patch" transducers are designed as thin layers of piezoelectric ceramic embedded in protective foil and thanks to disposition of piezoelectric effect can be used both as sensors and actuators. The tested structure was a cantilever sandwich beam with two piezoelectric patches. The beam was loaded by the actuator using a chirp and sine signals. Frequency characteristics, such as natural frequencies and amplitudes of oscillations, were obtained from the response measured by the sensor. A finite element model of the beam with transducers was created in Ansys using solid elements. The tests were simulated by harmonic and transient analyses. Frequency characteristics of the computational model were determined and compared to those obtained by the experimental measurement.

MONITORING OF SCC OF STAINLESS STEEL UNDER INCREASED TEMPERATURES AND PRESSURES

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The aim of the presented contribution has been to upgrade the previous SCC research [1,2] done under normal temperatures and pressure. Current research is monitored at higher pressures and temperatures, environments being similar and characteristic to the nuclear environments. The focus was to apply the previous knowledge in order to detect SCC and other degradation processes. The combined use of different techniques, such as electrochemical noise (EN) analysis, acoustic emission (AE) analysis, elongation measurements were applied to study SCC in the autoclave environment.

Presented results were obtained by slow strain rate tensile tests (SSRT) on thermally sensitized austenitic stainless steel (AISI 304) specimens under simulated BWR condition (T = 288°C, p = 71 bar, conductivity of water ~3 μS/cm). Additionally, a scratching device was used to mechanically damage the specimen surface with the aim of a surface passive film rupturing as the film rupture could be one of the mechanisms for crack initiation.

EN and AE signals were measured and analyzed during the experiments. Additionally, some other important experimental parameters were monitored during the experiment: force on a specimen, elongation of a specimen, autoclave pressure, and temperature. After each experiment, specimens were inspected for cracks and other damages by different techniques with the emphasis on SEM and X-ray microtomography.

In order to detect and characterize degradation process of specimen signals of EN, AE and force were analyzed and correlated. By correlation of signals characteristics several processes were successfully detected and explained: final failure of the specimen, corrosion due to increase of temperature, scratching of working and reference electrode and to the some extend also presence of SCC. Detected damages on and inside the specimen were additionally characterized and confirmed by SEM and X-ray microtomography.

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ATOMIC LEVEL CHARACTERIZATION OF VACUUM ANNEALED STAINLESS STEELS

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Vacuum science and technology is basically driven by two main goals. One goal is to maintain extreme low pressures. Specialized applications like accelerator and storage ring facilities or the processing of advanced semiconductor devices make need for extreme high vacuum (XHV). The second demand is speed. Short cycling times are an essential issue in large scale vacuum processing of consumable goods ranging from PET bottle coatings to DVD's. Both demands strongly depend on the properties of the wall material especially the degassing and outgassing behavior.

Stainless steel (SS) is one of the most commonly used constructional materials for vacuum chambers and components. Special applications like accelerator, storage ring facilities or advanced semiconductor device processing make need for extreme high vacuum (XHV). In the XHV regime a reduction of the outgassing rates of the materials used in the construction of the vacuum system is essential. Beside surface treatment to reduce the surface roughness high temperature vacuum annealing (vacuum firing) became a widely accepted practice of reducing the amount of hydrogen dissolved in SS. It is well established that the rate of outgassing depends strongly on the atomic structure of the surface.

In order to gain atomic level information on the real morphology of a surface after common bake-out and vacuum firing SS samples were imaged in the atomic force microscope (AFM) and the scanning tunneling microscope (STM). The surface composition has been established by complementary atom probe depth profiling analysis. The main experimental work has been carried out on a combined STM - atom probe field ion microscope (AP-FIM) apparatus. A unique feature of the particular combined instrument is that it allows a fully-predictive preparation of STM probe tips in situ by FIM which is important for a reliable imaging of complex surfaces.

The surface after vacuum firing shows significant reconstruction with formation of large flat terraces which can be assigned to (111) planes. These terraces are bounded by bunched steps and facets corresponding in orientation almost to (110) planes and (100) planes. The deep grooved grain boundaries, facets and bunched atomic steps represent very active sites for adsorption and recombination of hydrogen. This is supported by theoretical calculations which show that this step sites are electronically very close to subsurface states. The atom probe analysis gives evidence of surface segregation of nickel which may also promote hydrogen recombination.

A close up view on the large (111) terraces by STM show that there are a lot of vacancies too. Theoretical studies and simulations on the interaction of hydrogen with lattice imperfections provide a new insight in hydrogen outgassing. The energy calculations using the ASED method (Atom superposition and Electron Delocalization) result in lower energy levels in tetrahedral sites in Fe vacancies. It supports the picture that surface and subsurface defects form traps with different energetic levels. They may also control the recombinative desorption process and give additional explanation for the observed hydrogen outgassing behaviour of stainless steel.

INVESTIGATION OF MECHANICAL PROPERTIES AND STRUCTURE OF SPECIAL NON-FERROUS ALLOYS BASED ON MAGNESIUM

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Alloys based on magnesium thanks to their high specific strength together with low density have an extensive potential for castings using in automotive industry. Castings based on these materials shows relatively good mechanical properties, which are markedly decreased by increasing temperature of their thermal exposure.

This aim of this work is study of these properties both of alloys commonly used (of the Mg-Al-Zn, Mn type), and of that ones used in industrial manufacture in a limited extent (Mg-Al-Sr). From the studied materials the test castings were made from which the test bars for the tensile test were subsequently prepared. This test took place within the temperature range of 20 °C – 300 °C. These thermomechanical properties are further on complemented with the microstructure analysis with the aim of checking the metallurgical interventions (an effect of inoculation).

ASSESSING QUALITY OF CORROSION EDUCATION IN THE UNITED ARAB EMIRATES

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The economic, environmental and societal consequences of corrosion failure could be minimized by an engineering workforce well trained in corrosion fundamentals and corrosion management. The United Arab Emirates (UAE) incurs the second highest annual cost of corrosion after Saudi Arabia given its dependence on its oil/gas industries. Hence, this study examined the quality of corrosion education in engineering programs of universities in the UAE. A single-embedded case design was adopted with the engineering education program as the primary case and universities as subunits within the main case. Academia and industry respondents were surveyed with the latter providing the employers' perspective on the competence of engineering graduates in corrosion.

The findings showed that dedicated corrosion courses and engineering courses that integrated corrosion into the curricula were available in UAE universities. Elaborations were obtained from academia respondents on reasons for the extent of corrosion instruction available. Concerning competence of engineering undergraduates/graduates, the consensus view was that there was insufficient fundamental knowledge of corrosion engineering. Another dimension of competence is the ability to apply the theoretical knowledge in practice. The industry respondents were highly critical in their perception that graduate engineers had superficial understanding of corrosion in real-life design contexts.

The effectiveness of engineering curricula in corrosion is determined by both competence in corrosion knowledge/skills and the availability of resources (qualified faculty and new knowledge from research) to support corrosion education. The findings showed that most departments would not hire new corrosion-specialist faculty. However, the aspect of research is more encouraging with universities reporting availability of department research and industry partnerships in corrosion research. This paper concluded with recommendations for improving knowledge and skills of future engineers in corrosion management as well as enhancing corrosion instruction to better meet industry needs.

A NON-SINGULAR METHOD OF FUNDAMENTAL SOLUTIONS AND ITS APPLICATION TO TWO DIMENSIONAL MULTI-BODY ELASTICITY PROBLEMS

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The purpose of this paper is to develop an effective numerical method that would allow to study micromechanics of multi-grain systems. The numerical method will form a part of the microstructure deformation model, coupled with the macroscopic simulation system for continuous casting, hot rolling and heat treatment. The application of a non-singular method of fundamental solutions (NMFS) in two-dimensional isotropic linear elasticity is originally developed in [1], where the NMFS is based on the Method of Fundamental Solutions (MFS) with regularization of the singularities. In the traditional MFS, a fictitious boundary for placing the source points is required, in order to cancel out the singularity of the FS. However, in the NMFS, the source points and the collocation points coincide and both are positioned on the boundary of the problem domain. This removes the need for artificial boundary and allows the method to be employed in multi-grain sense. In order to remove the singularities of the FS, (the Kelvin FS is employed to collocate the governing plane strain force balance equations), are the concentrated point sources replaced by the distributed sources over circles around the singularity [2]. The values of distributed sources are calculated directly and analytically in case of the Dirichlet boundary conditions. In case of Neumann boundary conditions, the respective values of the derivatives of the FS, as required in the calculations, are calculated indirectly from the considerations of the solution of the linearly varying and simple displacement fields [3]. Examples of two-dimensional isotropic multi-grain linear elasticity problems are presented, with mixed boundary conditions, to demonstrate the feasibility and the accuracy of the newly developed approach.

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INVESTIGATION OF THE PROPERTIES OF TITANIA COATINGS ON Ti-BASED ALLOYS SUBSTRATES FOR BODY IMPLANTS

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The field of orthopedics has been greatly developed in the past few decades due to the increasing need for joint repair. Among the available materials for body implants, titanium and its alloys are the most used for bone replacement, since they own good mechanical properties and biocompatibility. However, a weak osseointegration and an early aseptic loose can result in implant failure. To avoid that, an appropriate combination of surface roughness and surface chemistry are required.
Within the available surface modification technologies, in our study hydrothermal treatment of various Ti-based alloys disks was chosen as technique to convert the natural passivation layer, composed of amorphous titanium dioxide, into a polycrystalline TiO_2 anatase coating.
As semiconductor, TiO_2 presents photocatalytic activity, if activated by UV light; thus, our purpose was to study the photocatalytic and superhydrophylic behaviors of our TiO_2 coatings after UV irradiation, in order to obtain self-cleaning surfaces and improve their biocompatibility.
After hydrothermal synthesis, characterization of the coatings was performed: FEG-SEM was employed to check the morphology of TiO_2 crystals; sessile drop contact angle measurements was used to verify the photo-induced variations in wettability; spectrophotometry and EPR techniques were used to verify the photoactivation and the photo-induced organics degradation ability of the coatings. Moreover, preliminary bacteria tests were performed to verify the capability of the photo-activated anatase layers to prevent adhesion and viability of bacteria.
The results suggest that the combination of controlled synthesis of crystalline anatase films by HT and their related photocatalytic properties could offer the potential of creating biocompatible and anti-bacterial coatings on medical device surfaces, in order to ensure a better osseointegration after surgery.

THE CRYSTALLIZATION OF ANORTHITE AND ITS EFFECT TO THE PROPERTIES OF THE LTCC MATERIAL

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Low temperature co-fired ceramics (LTCCs) are important glass-ceramics composite materials mostly used for multilayer circuits in automotive and communication applications. Materials and processing techniques used for production of the ceramics multilayer circuits can also be applied for the production of the complex 3D ceramics structures with buried channels and cavities used as Micro-Electro-Mechanical Systems (MEMS). Most of the LTCCs are composed of low softening point glasses and alumina ceramic filler. The glass phase and the ceramic filler are usually designed to yield the crystallization of the glass phase. The crystallization reduces the glass content in the material and influences functional properties.

In our investigation the DuPont 951 LTCC samples were fired for 15 minutes at temperatures between 600 °C and 1000 °C. After firing the phase compositions and the microstructures of LTCCs were analysed and correlated with the mechanical properties, such as flexural strength and temperature coefficient of expansion. The analysed LTCC is composed of alumina particles embedded in a lead borosilicate glass matrix. It was found that 20 % of initially present alumina filler dissolves in the glass phase during the firing between 700 and 800 °C and forms alumina enriched area around alumina filler particles. The enriched areas are suitable for crystallization of the anorthite phase which nucleates and crystallizes on the on the surface of alumina particles. The amount of anorthite is increasing with increasing firing temperature up to 22 wt. % when all alumina enriched glass suitable for crystallization is consumed. The measured biaxial flexural strength increases from 150 MPa (at 800 °C) to around 300 MPa (at 900 °C), and it remains constant at higher temperatures. The anorthite phase changes the crack propagation mechanism. When the anorthite crystalizes around the alumina grains the crack propagates through the glass phase and through the anorthite phase, while in LTCC without the anorthite phase the crack propagates through the glass phase and is deflected by alumina grains.

MAGNETIC SHAPE MEMORY EFFECT IN Ni-BASED ALLOYS

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Magnetic shape-memory alloys are considered to be active materials enabling rapid, large-strain actuation upon application of a magnetic field [1,2]. This is due to twin boundaries movement under the influence of an internal stress produced by magnetic anisotropy energy, and is not recovered upon removal of the field [1–3]. Magnetoplasticity has been extensively studied for off-stoichiometric Ni_2MnGa Heusler alloys (e.g., [1–8]), which as single crystals exhibit large magnetoplastic strains (up to 10% when optimally oriented to the magnetic field [4,8]) due to deformation by twinning and a large magnetic anisotropy constant [2]. Since the growth of Ni-Mn-Ga single crystals is slow and leads to severe segregation [9], affecting local composition, crystal structure, and magnetoplastic strain [10] we have adopted a way of synthesis of the Ni_2MnGa via arc-melting. This, followed by subsequent annealing of alloys, mitigated the problem of segregation. Subsequent liquid melt infiltration into a sodium aluminate-based foam resulted in a polycrystalline magnetic shape-memory alloys with single and bimodal open porosity that can exhibit magnetoplastic strains (produced solely by magnetic forces at constant temperature and without mechanical bias stress) negligibly small as compared to single-crystal values [11].

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EXPERIMENTAL AND NUMERICAL INVESTIGATION OF AN AIR-PCM HEAT EXCHANGER

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Heat exchangers represent the forefront technology of heat transfer from one medium to another. The media are generally separated by a solid wall, so that they never mix. For thermal storage, water can easily be used but it is less practical for air-based systems. In this paper, the special case of air-based solar thermal systems with phase change material (PCM) has been investigated. The PCMs are materials with a high latent heat of melting and can be used in various thermal storage applications[1]. This paper represents both a measurement from the experimental heat exchanger which comprise 100 PCM panels and a numerical simulation. The scheme of the exchanger and the laboratory set-up is shown in Fig. 1. The mentioned case was numerically simulated with the use of coupling between the TRNSYS 17 and the MATLAB. The numerical model is based on the implementation of the 1D heat transfer equation that includes a source of latent heat of phase change[2]

$$\frac{\partial}{\partial \tau}(\rho c T) = k_{eff}\frac{\partial^2 T}{\partial x^2} + \dot{Q} \tag{1}$$

The properties of the PCM were investigated by means of the differential scanning calorimetry (DSC). The melting range from 38 °C to 43 °C, heat storage capacity of 174 kJ/kg. The numerical simulation was validated by an experimental measurement. The results prove that use of the PCM in the heat exchanger has significan heat storage effect.

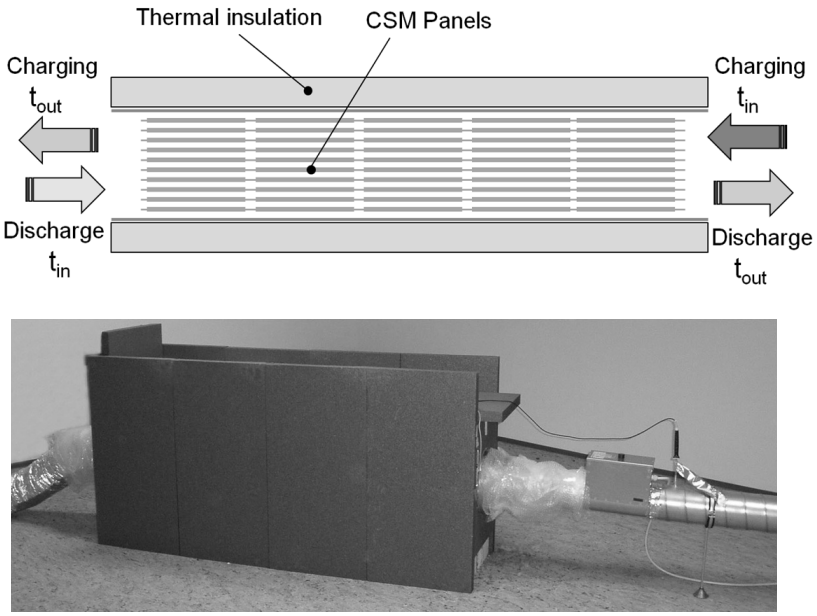

Fig. 1 Schematic view of the heat storage unit and experimental device

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THERMODYNAMIC OPTIMIZATION OF HIGH ALLOYED STEELS

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The proposed article discusses the solidification and cooling of high alloyed steels as a part of thermodynamic optimization. These steels are usually alloyed with: C, Cr, W, Mo and others. Because of its complex phase composition the production and processing of these steels is very difficult. During the solidification and cooling processes, several microstructure constituents are formed from the liquid state and precipitation also occurred in solid state. The equilibrium isopleths phase diagrams Fe-C (Fig.1) and phase shares vs. temperature (Fig.2) for steels were calculated. The thermodynamic calculations confirm the results from thermal analyses and the related microstructure. Using slow cooling rate for observation of thermal effects, the results of thermodynamic calculations and results obtained from simultaneous thermal analysis shows us correspondence of solidification of individual phases. The important detail is the amount of individual phases and their composition.

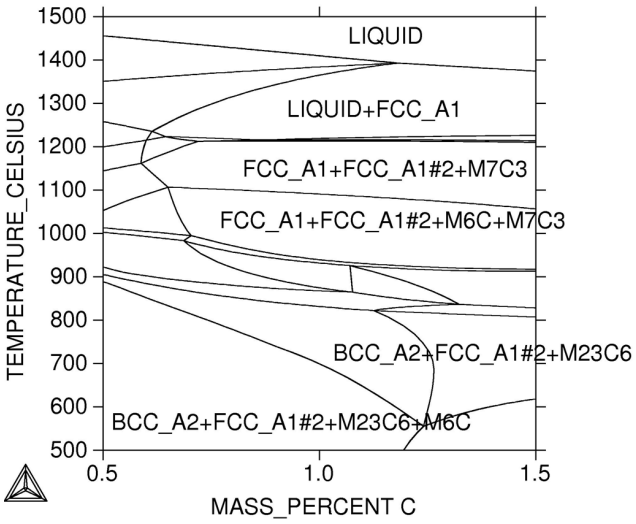

Fig.1: Isopleth phase diagram Fe-C for CRV2

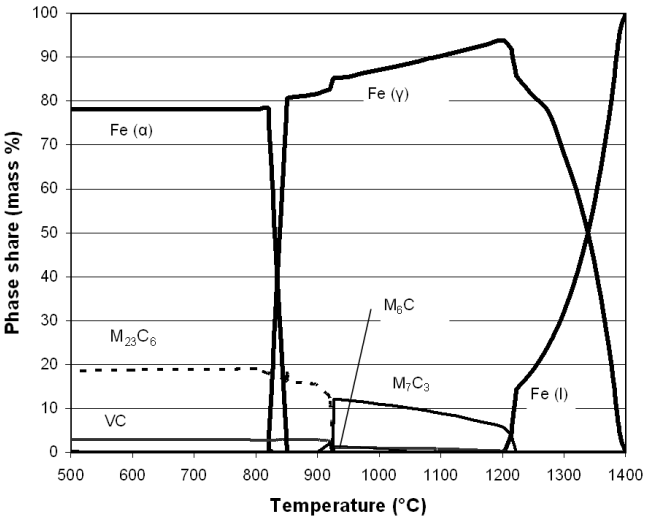

Fig.2: Phase share in temperature interval 500–1400 °C for CRV2

POSSIBILITIES OF DESULPHURIZATION OF TOOLS ALLOYED STEEL IN THE VACUUM OXYGEN DECARBURIZATION (VOD) EQUIPMENT WHILE USING CHEMICAL HEATING

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The paper deals with the possibilities of controlled desulphurization of alloyed tools steel in the VOD equipment while using chemical heating and standard slag-making additions. Slag composition after chemical heating of melt is unfavourable for desulphurization. Therefore it was necessary to develop new production technology, which would reduce the products of chemical heating and thus maximum degree of desulphurization could be achieved. The results were compared with micro-cleanliness of steel using microanalysis of the non-metallic inclusions.

CHARACTERIZATION OF DREDGED SEA MUD FROM THE PORT OF KOPER AND ITS POTENTIAL FOR APPLICATIONS IN CIVIL ENGINEERING – PRELIMINARY RESULTS

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The Port of Koper, as one of the biggest and the most important ports in the Northern Adriatic Sea, constantly faces problems caused by the accumulation of marine sediments inside different parts of the port, which result in disturbances in some of the Port's crucial operational properties. A total of 0.45 million m^3 of sediment have to be removed annually. This sediment is a mixture of clay and silt (the term "mud" is used in the following text), which is anthropogenically polluted by certain heavy metals and chlorides, and thus represents a kind of waste for which there is insufficient disposal space along the Slovenian coast.

According to the well-known slogan "No waste here, just resources!" this sediment can be viewed as a potential raw material, particularly in the field of civil engineering, mainly for two reasons: in this field it is possible to use large quantities of sediments, and it is also possible, by means of different remediation processes, to permanently immobilize the hazardous substances in various types of composites (1).

In order to define the best way in which to use this sediment in civil engineering applications, an extensive research project is under way. This project focuses on: (i) the accumulation of mud as a consequence of local geological processes, (ii) the chemical, mineralogical and mechanical-physical properties of the mud, (iii) the degree and type of pollution, especially with regard to the content of biologically easily accessible pollutants (2), and (iv) possibilities for the environmentally safe and technologically functional implementation of sediments into construction products and structures in accordance with the principles of a sustainable building and civil engineering industry (3, 4). The preliminary results are presented and discussed in the paper.

The results were obtained within the scope of the ARRS project "Sediments in aquatic environments: their geochemical and mineralogical characterization, remediation, and use as secondary raw materials", 2011-1014.

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STRATEGIES FOR SUCCESSFUL COLLABORATIVE RESEARCH BETWEEN ACADEMIA AND MANUFACTURING INDUSTRIES

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Universities and other government-funded research organisations offer great potential for enhancement of the research capacity of manufacturing companies. No company can afford to employ all the science and technology expertise required for process and product innovation, and the wealth of knowledge and skill employed in the public sector is an obvious resource for collaboration.
However, there are clear differences in the way that companies and universities / institutions function, particularly in their respective priorities and modes of operation. Successful collaborative partnerships depend on mutual understanding of partner needs and agreement to build personal and organisational relationships of mutual benefit over the long term.
Within this context, key needs of both industry and academic partners are discussed, and a strategy for successful research projects is presented. The need for developing long term relationships and strategies for developing industry-capable researchers is also addressed, calling on more than 20 years of experience in industry-collaboration in the context of the Australian steel industry.

HEAT FLUX COMPUTATION FROM MEASURED TEMPERATURE HISTORIES DURING HOT ROLLING

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Due to the long shelf life of working rolls it is very important to follow the thermal load but it is very difficult to measure it. One option is to measure temperature and to study the thermal load through heat flux. A unique working roll was made for testing different process conditions such as rolling velocity, roll cooling, skin cooling, and reduction. This working roll was tested on a real hot rolling pilot line. Two types of temperature sensors were embedded in the working roll in order to measure the temperature and they gave very detailed information about the development of temperature inside the work roll.

Time dependent heat flux was computed using inverse heat conduction task using detail numerical model. Surface temperature history was also obtained from this computational model. These boundary conditions give detailed information about the influence of different process conditions and allow computation of temperature field in the work roll.

The paper describes measuring equipment, details of used temperature sensors, inverse heat conduction task for computing thermal surface boundary conditions and the results obtained from real plant conditions.

SEWAGE SLUDGE STABILIZATION BY BIOMASS ASH

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Sewage sludge, due to the high organic content, presence of pathogenic bacteria and often heavy metals, pose a major environmental problem. Environmentally very demanding is also managing different waste ash residues, which some of them were already successfully applied in field of construction. This is not a case for ashes from biomass combustion. By mixing waste biomass ash and biodegradable sewage sludge a composite construction material for specific purposes can be obtained. In view of sustainable development this presents an optimal – zero waste solution.
Research has shown that process of stabilization of sewage sludge, which is a fluid component (it contains minerals calcite, quartz, kaolinite, dolomite and illite), with biomass ash, which contains three active components (free CaO, portlandite and dicalcium silicate), because of the elevated temperature and pH value, effectively inhibit further microbial activity and the associated degradation. In the process a stable matrix is formed, which is in quantity and type of porosity similar to the matrix of lime mortar. In this way a composite building material with compressive strength of 1,5 to 2,5 MPa is produced. This can be used mainly in the area of landfill covers, road shoulders management and stabilizing road base, as well as in rehabilitation of degraded areas. The analysis of the chemical composition of the water eluate from the composite showed, that the new composite material is inert and as such does not pose a threat and do not burden to the environment.

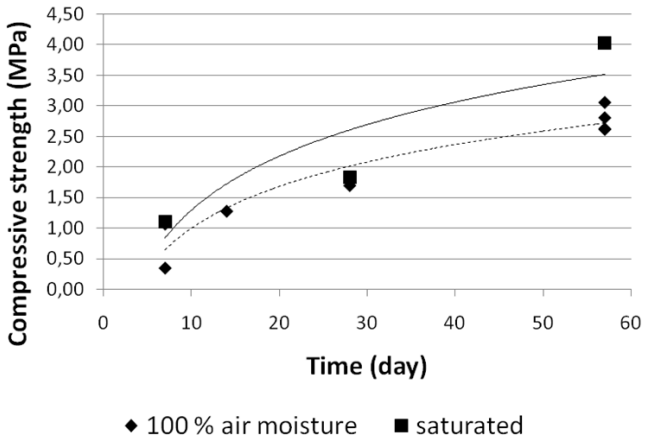

Figure 1: Compresive strength of composite material

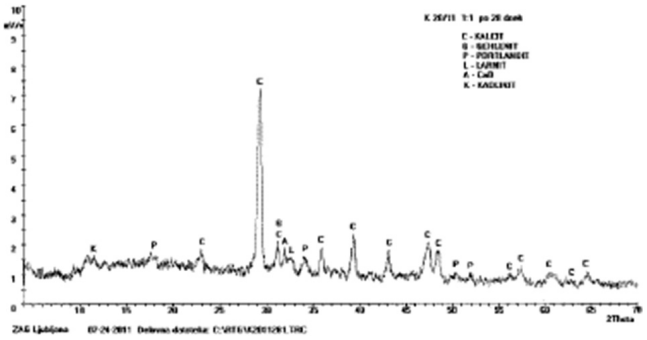

Figure 2: Composite material RTG

DETERMINING DIVERSE TOOL AND HIGH-SPEED STEEL PROPERTIES USING A SINGLE K_{ic}-TEST SPECIMEN

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Depending on the differences in the balanced alloy composition and steel processing technology, properties of tool and high-speed steel, like temper resistance, hot yield strength, ductility and toughness, thermal fatigue and shock resistance, as well as wear resistance can differ considerably among the same type of steel. High hot-yield strength, a high temper resistance and a good ductility tend to result in a high resistance to thermal fatigue, while resistance to mechanical and thermal shocks depends on the ductility and toughness. However, properties of tool and high-speed steels depend also on the final vacuum-heat-treatment process. Normally, hardness and fracture toughness are used to determine the influence of vacuum-heat-treatment parameters and to optimize it for the specific operating conditions of the tool. However, there are also other tool properties which are equally important and need to be taken into consideration. To determine such a wide range of properties different test procedures and different test specimens are required since none of the standard tests alone is capable of providing relevant properties completely. Currently the best overall appraisal of tool and high-speed steel applicability seems to be a combination of fracture toughness, bending or compression testing and in specific cases of impact or small-punch creep test. The aim of the paper is to show the possibility of using a single K_{Ic}-test specimen for determination of such a wide range of properties being crucial for tool and high-speed steels. Beside that usability of K_{Ic}-test specimen for assessment of technological properties such as nitridability, EDM, HSC, wear resistance etc. will be presented.

USING LINESHAPE ANALYSIS AND FOURIER TRANSFORM TO IMPROVE THE INTERPRETATION OF AUGER SPECTRA

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Auger electron spectroscopy (AES) and X-ray photoelectron spectroscopy (XPS) are two complementary techniques that reveal information about the outmost layers of the surface of the sample. From the peak positions we gain information about the nature of the elements present, while XPS has the advantage of also distinguishing the different oxidation states of the same element based on the position of the peak. In AES this is in part compensated from the utilization of lineshape analysis, where the line enclosing a characteristic peak representative of a certain element will take slightly different shapes when the element in question is bonded to different ones. Since the differences in lineshape are very slight and easily impaired by the presence of noise, dealing with noise is often an unavoidable task.

Another problem that must be dealt with in general for the proper interpretation of the Auger spectra is the background. Background interferes in the quantitative evaluation of the Auger spectra. While Fourier analysis has already been used to treat the problem of noise, our group has thought of using this method for the treatment of the background problem as well, among other techniques.

Thus in this work the utilization of lineshape analysis for the interpretation of Auger spectra and the use of Fourier analysis for the purpose of background removal and noise reduction are going to be discussed.

THE INFLUENCE OF OUTSIDE STRAIN ON THE ATOMIC RELAXATIONS AND VIBRATIONS ON STEPPED Cu AND Ni SURFACES

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In this study, the influence of outside strain on the relaxations and atomic vibrations due to steps on Cu and Ni surfaces is investigated for atoms near the surface. Molecular dynamics simulations were performed using LAMMPS Molecular Dynamics Simulator[1] and EAM potentials[2]. Steps on the crystal surface lead to a relaxation of the atoms near the surface in addition to the mean surface relaxation. The displacement fields of nearby steps interact with each other, forming different displacement fields for different configurations of steps. The simulation cell is deformed to generate outside strain. The changes in the displacement fields due to outside strain are investigated for different configurations of surface steps and a range of values for strain. Temperature dependence of the relaxations and atomic vibrations is also investigated and compared for the two metals.

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IMPACT OF MACHINE HAMMERING PEENING ON TRIBOLOGICAL PROPERTIES OF STEEL SURFACES

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Machine Hammer Peening (MHP) is a novel surface treatment, which creates smoother surfaces with a local hardness increase and compressive residual stresses well below the surface. A CNC controlled machine hammer with 5 axis of movement oscillates in axial direction at high frequency hitting repeatedly the working piece, while advancing along a predefined path. By these means relatively large working tools can be hammer peened within minutes. The main advantage of Machine Hammer Peening when compared to other surface treatments such as shot peening [1], is that MHP is a controllable and well-defined process that offers an excellent reproducibility

This works presents a number of applications, where MHP poses a potential improvement of functional surfaces in terms of tribological properties. We show how MHP steel surfaces have a smoother surface, which can be enhanced by adding texturing features. These surfaces are characterized by a higher hardness and the presence of compressive residual stresses up to 1 mm below the surface. The prepared MHP samples were tested using a SRV tribometer under reciprocating sliding conditions. Wear was measured using the Radio Isotope Concentration (RIC) method [2], which allows precise wear measurements in the nanometer range. Afterwards, the samples were analyzed post-mortem using various microscopy techniques. The results show that MHP increases wear resistance of the treated surface, while wear of the counter body increases.

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ANALYSIS OF THE INFLUENCE OF THERMOCHEMICAL TREATMENT ON STRUCTURE AND MECHANICAL PROPERTIES OF STEEL 20MnCr5

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In operation, the gear pumps are exposed to elevated pressures and temperatures. They allow the circulation of heated raw material in the injection molding machines for plastics. In one of these pumps, frequent downtime occurred due to the fracture of drive gear. The gears installed as the standard spare parts lasted only three months in operation.
Metallographic testing was performed on the fractured standard gear (Figure 1). The hardness of the cross-section and the surface was tested. The effective depth of the cemented layer was determined. The fracture surface was examined. The chemical analysis of the material was performed. Based on the analysis of results, it was determined that high hardenability of steel was the most probable cause for the fracture of standard gear.
Based on these results, and with the goal to extend the life of gear, 2 test gears were made of the case hardening steel 20MnCr5. Significant life extension of gear was achieved. The test gears were in operation for nine months after installation. The fracture of the test gear occurred in the same area as with the standard gear (Figure 2). The testing, which was used on the standard gear that lasted only three months in operation, was performed also on the test gear.

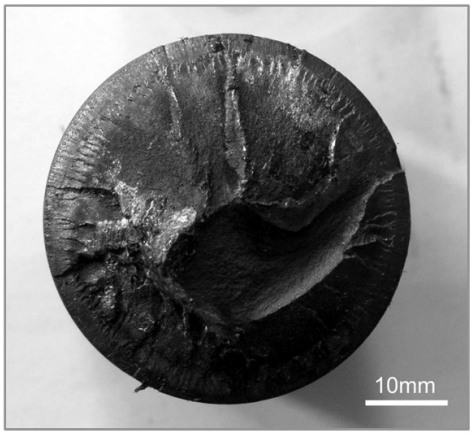

Figure 1 Shaft of standard gear (sample)

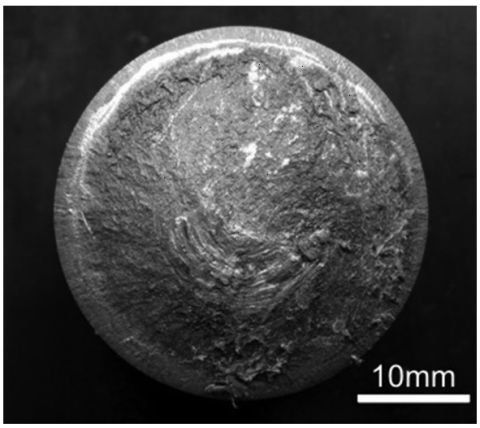

Figure 2 Shaft of test gear (sample)

Significant life extension was achieved by the optimal choice of material. The collected samples will be used for the further detailed investigation in order to determine the unambiguous cause for the fracture. Next to the analysis of properties of material, it is necessary to consider other factors that could be a probable cause for decreasing the life of gear.

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THE INFLUENCE OF SELECTED SYNTHESIS PARAMETERS ON THE STRUCTURAL AND FUNCTIONAL PROPERTIES OF NANOCRYSTALLINE TITANIA

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Electrical, optical, and photocatalytic properties of nanocrystalline titania depend on particle size, phase composition, microstructure, and chemical composition. Anatase and mixtures of anatase and rutile are most commonly used in photocatalytic applications [1]. Rutile has a narrower band gap than anatase and is photocatalytically active already under visible light irradiation. The mixture of the two species has been proven most photocatalytically active [2].

We have studied the influence of selected synthesis parameters on certain key properties (phase composition, specific surface area, microstructure and photocatalytic activity) of the nanocrystalline titania that influence its photoactivity. In order to produce the most photocatalytically active titania, especially in visual light spectrum, we have varied parameters such as the type of precursor, pH, isopropanol addition and starting (precursor) concentration. Additionaly various dopants were incorporated into the titania.

The morphology and size of particles were examined by field emission scanning electron microscopy (FE-SEM), phases were identified using X-ray powder diffraction (XRD), specific surface area of the powders was measured using a BET surface area analyzer and photocatalytic activity was quantitatively evaluated through the monitoring of degradation of a model organic polutant isopropanol in a sealed reactor system utilizing FTIR spectroscopy.

The results have shown that pH value, starting concentration, and isopropanol addition to the reaction mixture before heating have a significant effect on the anatase:rutile ratio and consequently on morphology and particle size. These characteristics of titania particles directly affect their photocatalytic activity. Additionaly it has been found that doping with different ions considerably increases photocatalytic activity under visible light. By varying the anatase:rutile ratio and by doping, photocatalysts with significant activity in the visible light can be tailored.

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THE MYSTERY OF THE MISSING CANS: UBC RECYCLING IN THE UNITED STATES

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From a high of 65% in 1992, the percentage of aluminium cans recycled in the United States fell to 50% in 2003, before slowly recovering over the last decade. The reason for this drop and subsequent recovery is a story of technology, markets, and public policy. The technology and history of aluminium can recycling in the United States will be reviewed, focusing on the impact of changes on the recycling rate, and implications for the future.

PREPARATION AND ANALYSIS OF Ni-SDC MATERIAL FOR SOFC APPLICATION

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Nickel-samaria doped ceria (Ni-SDC) is a very promising new anode material for SOFC systems. It exhibits superb ionic and electronic conductivity at intermediate temperatures (400 °C – 700 °C) when compared to Ni-YSZ. Ni-SDC is a composite material and it requires careful microstructural and compositional tailoring. Following the microstructural and compositional changes during the material preparation was the main goal of this study. Ni-SDC was synthesized by a simplified Pechini method by the reaction of metal acetates with ethylene glycol, the later serving as a chelating agent as well as the reaction medium. Originally, molar ratio between cerium and samarium in the ceramic matrix was 80:20 and the overall nickel content in the final product was originally set to 55 vol%.
During the material preparation several different intermediates were synthesized (i.e. powdered product after the synthesis, oxide mixture after calcination, mechanically grinded powder after milling, sintered oxide mixture and final reduced anode material), which may differ according to their chemical and morphological properties. In this respect, the chemical composition of the material expressed as concentrations of nickel, cerium and samarium was followed through the preparation sequence using various analytical techniques i.e. the volumetric and gravimetric methods, ICP-AES, SEM-EDS and XRD. It appears that the obtained results diverge consistently with the used analytical techniques. The best analytical approach with regard to its accuracy, repeatability, time required and costs was critically evaluated at each preparation step. There is no unique answer which analytical method should be used at various preparation steps. Instead, suitable analytical method is chosen with respect to the analyzed material appearance and its morphological and microstructural characteristics.

OPTIMALISATION OF SLAG MODE IN THE LADLE DURING STEEL PROCESSING AT SECONDARY METALLURGY

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Requirements to steelmaking industry concerning quality and service properties of steel are continuously growing. One of the possibilities for fulfilment of these requirements within the scope of the secondary metallurgy is optimalisation of slag mode in the ladle. Process of formation of ladle slag is rather complicated and it depends on quantity of slag-making agents (CaO and synthetic slags based on Al_2O_3), method of steel desoxidation, intensity of stirring, corrosion (wear) of ladle lining and quantity of furnace slag that overflew. The chemical composition of slag is modified by other additions of slag-making agents during steel treatment by secondary metallurgy, but also content of easily reducible oxides is decreased in order to create sufficiently basic, liquid slag with low melting point, which contributes to acceleration of physical-chemical processes at the slag-metal interface, by which it influences efficiency of metallurgy processes [1,2].

The paper relates to works of the authors [3,4] and is focused on optimisation of ladle slag by briquetting fluxing agents (based on Al_2O_3) in various technological conditions in the steelworks of TŘINECKÉ ŽELEZÁRNY, a.s. The aim of plant experiments was to compare various variants of proportions of slag-making agents and of desoxidising agents with focus on evaluation of achievement of optimum chemical composition of slag, enabling enhancement of kinetic conditions of the refining ladle slag during treatment on secondary metallurgy units. The work was created within the frame of the program MPO-TIP at solution of the projects reg. No. FR-TI2/319 and reg. No. FR-TI1/240.

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MICROSTRUCTURAL ENGINEERING OF Nd-Fe-B MAGNETS

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NdFeB sintered magnets exhibit excellent magnetic properties at room-temperature. Maximum energy product of NdFeB magnets can be as high as $(BH)_{max}$ = 474 kJ/m^3 [1]. With increasing temperature, magnetic properties are decreasing undesirably. This is disadvantage in applications where magnets are exposed to elevated temperatures (electric motors). To avoid this phenomenon, commercial NdFeB magnets can be doped with terbium using the so-called grain boundary diffusion process (GBDP). In this process intergranular Nd-rich phase become a liquid and therefore Tb can easy diffuses along grain boundaries and also into the outer parts of $Nd_2Fe_{14}B$ grains. GBDP's results are core-shell structures with Tb-rich shell and Tb-free matrix core. Such Tb-doped magnets exhibit 30% higher coercivity than non-treated magnes and for that reason they are more appropriate for automotive applications.

According to magnetic properties, measured with Lakeshore vibrating sample magnetometer (VSM), we know that there must be terbium-rich shell around matrix grain present even in the centre of magnet. Pure tetragonal $Tb_2Fe_{14}B$ compound has anisotropy field, H_a = 28 MA/m, which is 16 MA/m more than $Nd_2Fe_{14}B$ phase [2]. For that reason coercivity in Tb-treated magnet is higher than in non-treated sample. However, Tb-treated sample has small reduction in remanence due to antiparallel coupling between Tb and Fe.

Commercially available anisotropic sintered NdFeB magnets were modified by Tb using the GBDP. In the first step rectangular sample with thickness of 2 mm was first covered with Tb-oxide powder by dipping into a Tb_40_7-ethanol slurry and then dried with hot air. In the next step coated sample was heat treated at 850°C for 10 hours and later at 500°C for 1 hour in an argon atmosphere. At elevated temperature the Tb diffuses along the grain boundaries from the surface towards the centre of the magnet. During diffusion Tb also reacts with the outer part of $Nd_2Fe_{14}B$ matrix grain and forms core-shell grains. Throughout most of the magnet this shell is very thin, only near the surface it is up to 2 μm thick. This is due to Tb-concentration-gradient across the sample.

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PROTECTION OF $Nd_2Fe_{14}B$ MELT SPUN RIBBONS BY SOL GEL DERIVED FILMS OF SiO_2 AND Al_2O_3

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NdFeB-based magnets are the most widely used magnets at present time, with applications ranging from auto industry to computers. Melt spun ribbons of NdFeB are used to produce bonded NdFeB magnets. However, their use is limited to low temperatures and low humidity environments, due to their poor corrosion resistance. Therefore, there is great need for very efficient coatings, which would expand the range of applications of bonded magnets. A coating composed of SiO_2 and Al_2O_3 was prepared by sol gel with the intention to improve the corrosion properties of $Nd_2Fe_{14}B$ magnetic powders, prepared by melt spinning. Corrosion properties of as-spun and coated powders were compared by exposing all powders to HAST test and measuring weight change. Coating layers were determined by AES, XPS and Raman spectroscopy. As-spun and coated powders were analysed by SEM, AES and EDS. Magnetic properties of as-spun and coated powders were compared by VSM. Both SiO_2 and Al_2O_3 proved to provide a uniform coating for the melt spun ribbons, which provided good corrosion resistance, with the weight change three times smaller compared to bare, as-spun NdFeB ribbons. No drop in magnetic properties was found in case of Al_2O_3 coated powders, a small drop from 8300G to 7800G was found in case of SiO_2 coated powders, opposed to non-coated particles, where coercivity dropped from 8300G to 6700G. Only slight change in remanence was found in all cases. This expands the range of use of NdFeB bonded magnets to applications which work in demanding conditions, with temperatures as high as 110 °C and 90% humidity.

INTERACTIONS OF GRAIN BOUNDARY TRIPLE POINTS, PRECIPITATES AND PORES WITHIN A HETEROGENEOUS MICROSTRUCTURE AND THEIR INFLUENCE ON INTERNAL STRESS AND STRAIN DISTRIBUTIONS

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The microstructure of a material is defined as the totality of all thermodynamic non-equilibrium lattice defects and phases on a spatial scale that ranges from Angstrom to meters. Its characteristic nature is related to the composition, the thermal heat treatment and processing history.
This microstructure significantly influences the behaviour of metallic materials, e.g. as creep behaviour, which is defined as the time-dependent deformation under the influence of mechanical stress. Thus, the explicit depiction of the local, heterogeneous microstructure is of major importance in materials modelling.
In this a finite element model which depicts a microstructure on a length scale within the range of larger precipitates and grains explicitly and where defects as pores are intrinsically incorporated has been set up. This approach combines different microstructural elements as grain boundaries, the bulk material and precipitates to investigate local effects within the microstructure of steels on internal stresses and strains during creep.
In contrast to most other finite element approaches where the grain boundaries coincidence with element boundaries, this model introduces well-defined grain boundary elements. This opens the possibility to map grain boundaries with an amorphous structure explicitly. This approach is used to simulate creep for various microstructural arrangements including grain boundaries, triple points and precipitates. A special focus is set on triple points including different angles and orientations relative to the loading direction. The formation of pores in high stress regions is simulated by using an approach for damage evolution. Furthermore, the influence of large precipitates on stress distributions and creep straining is studied.
Concerning creep behaviour, diffusional creep is simulated where the resulting strains are linearly dependent on the applied stresses. The results show that the heterogeneous microstructure of a material highly influences internal stresses and strains on a local basis.

TRANSFORMATION OF ILMENITE TO RUTILE AND HEMATITE PSEUDOMORPHS FROM MWINILUNGA (ZAMBIA)

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Samples of rutile and hematite pseudomorphs from Mwinilunga (Zambia), were investigated by optical microscopy, X-ray powder diffraction (XRD), scanning and transmission electron microscopy (SEM and TEM). The pseudomorphs retained the platelike morphology of the original crystals. Optical microscopy of polished thin sections, prepared from the inner part of the crystals, revealrd sub-microcrystalline texture of transparent rutile areas within hematite matrix. Although polycrystalline, rutile grains form distinct 120° domains, induced by a topotaxial growth on the corundum-type precursor. Within nanocrystalline domains of rutile macroscopic, twinned rutile crystals are emerging. These crystals adopt the orientation of the originating polycrystalline matrix. In nature, twins are commonly associated with a topotactic replacement of hematite or ilmenite by rutile, due to structural similarity. They do not have a definite three-dimensional form and the transformation is governed by rearrangement of the cations across the interface, while a hexagonal stacking of the oxygen sublattice remains unaltered (Force *et al.* 1996; Daneu *et al.* 2007). On a submicron scale we have confirmed a nanocrystalline nature of rutile and hematite precipitates by TEM. The possible mechanism of recrystallization includes the action of acidic hydrothermal solutions (Janssen *et al.* 2010). Under low pH values ilmenite rapidly alters to fine crystalline rutile following a dissolution-precipitation mechanism. During transformation due to the volume difference between the ilmenite and rutile, porosity is formed and pores are then filled-up by nanocrystalline hematite. Throughout the alteration process morphology of the precursor ilmenite crystal is preserved.

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STYRENE ACRYLIC COPOLYMER SYNTHESIS IN HIGH PRESSURE REACTOR

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Styrene acrylic copolymers are widely spread in coatings industry as one of the main components of the coating formulation. From process control point of view the copolymer synthesis reactions are desired to be controlled via inflow of fresh monomer mixture. This can be achieved by conducting the synthesis in high pressure reactor at temperatures above the boiling point of the solvent at atmospheric pressure. Higher temperatures enable faster kinetics and fresh monomers are consumed almost immediately after they are dosed into the reactor. Therefore, process is controlled by transport and not by kinetics of the polymerization. Processes led in such way result in copolymers with lower average molecular masses and narrower molecular mass distributions as well as lower viscosity. Described procedure enables the synthesis of styrene acrylic copolymers with higher solids content.[1–4]
In present work, high-solids styrene acrylic copolymer suitable for application in two-component polyurethane anti-corrosion coatings has been synthesized in high pressure reactor. Comparison between currently used material and new styrene acrylic copolymer showed better cross-linking of the latter. This reflects in lower porosity of dried films and better anti-corrosion protection of metal substrate (measured via electrochemical impedance spectroscopy). Improvements of mechanical properties such as elasticity and resistance to impact were also detected in this research.

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FOCUSED ION BEAM INDUCED DEWETTING OF A THIN Au FILM

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Thin films, with their thickness in the few ten nanometers range, become unstable upon melting and self-organize into characteristic nanoscale patterns in the form of percolated networks and spherical droplets. Focused ion beam irradiation of a thin film leads to a similar pattern development, even though the melting mechanism is different and there are also sputtering effects to be taken into consideration (1).

The proposed work focuses on gold thin film nanostructuring by dewetting. Thin films of Au were deposited on silicon substrates and irradiated with a Ga^+ ion beam. The resulting patterns (see Figure 1) follow a series of characteristic steps, starting with roughening of the substrate, development of percolated networks and the final steps consist of a completely dewetted film, until all of the film is sputtered away by Ga^+ ions. The patterns exhibits a characteristic length, which can be determined from the ring-shaped 2D FFT image, and it depends on the initial film thickness.

The presented paper will discuss the characteristic pattern development under Ga^+ ion irradiation of Au thin film, the temporal evolution and the thin film thickness dependence.

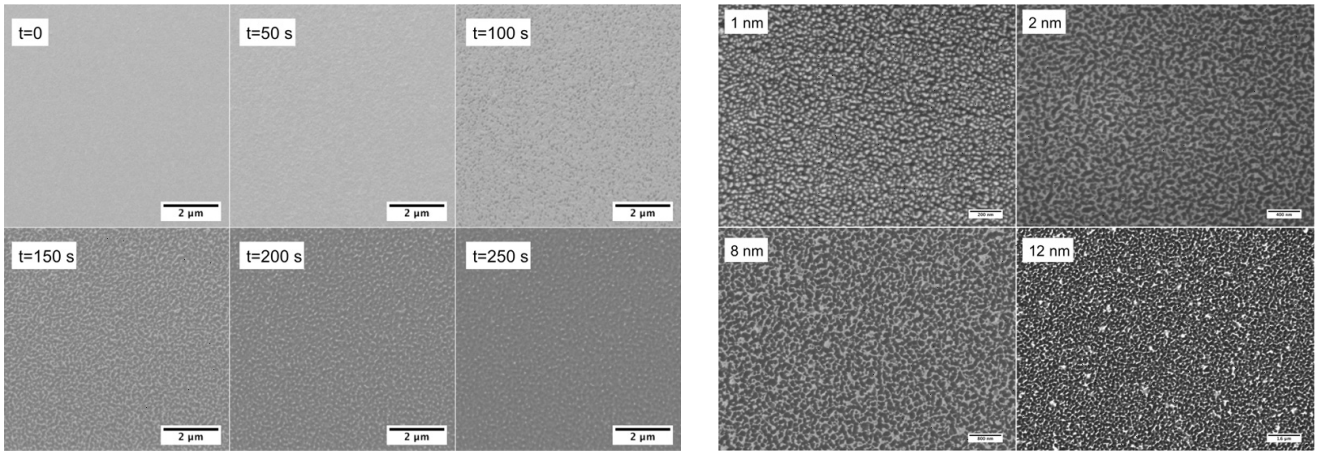

Figure 1: (a) A 15 nm thick Au film dewets upon Ga^+ focused ion beam irradiation. The images give a sequence of irradiation times (ion flux = $6.7 \cdot 10^{13}$ ions/cm^{2}s). (b) The characteristic pattern depends on initial film thickness.

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CHARACTERIZATION OF POLY(STYRENE-*b*-ISOPRENE) MIKTOARM STAR COPOLYMERS OF THE PS(PI)$_x$ TYPE BY DIFFERENT CHROMATOGRAPHIC TECHNIQUES

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The investigated PS(PI)$_x$ miktoarm star copolymers consist of two chemically different blocks or arms; one polystyrene (PS) arm of approximately the same length in all samples, and different numbers and lengths of polyisoprene arms (PI) (x = 2, 3, 5 and 7). Miktoarm star copolymers were synthesized by anionic polymerization and subsequent coupling of the arms onto chlorosilane coupling agent.[1] The characterization of such star copolymers is challenging due to possible presence of the homopolymers and different by-products, typically the stars with missing arm(s).[2] Size exclusion chromatography (SEC) solely does not provide us with the information regarding the chemical composition distribution and, in addition, the resolution power of SEC is insufficient since the hydrodynamic volume of the miktoarm star copolymers changes only little with the number of PI arms. Therefore, other chromatography techniques were used to separate such samples into the individual constituents.[3,4] The aim of our work was to determine the chemical composition distribution as well as the molar mass distribution of various PS(PI)$_x$ miktoarm star copolymers using gradient reversed-phase liquid chromatography (RP-LC) alone and in combination with SEC (two-dimensional liquid chromatography). The samples were also off-line fractionated by RP-LAC and the fractions analyzed by SEC/UV-MALS-RI multi-detection system and ^{1}H NMR. The results of all characterization techniques indicate that the samples consist of minute amounts of homo-PS and homo-PI as well as the high-molar mass species, which result from the coupling reaction. In addition, the stars, containing lower number of PI arms than predicted from chlorosilane functionality were also detected.

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TRANSFORMATION-INDUCED PLASTICITY IN STEEL FOR HOT STAMPING

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Production of car body parts using the hot stamping process was patented in 1977 and since then its use has risen sharply. Its advantage lies mainly in the precise shape of the resulting parts, the lower spring-back effect and the high strength of the hardened steel structure. For this technology a group of steels alloyed with boron and manganese was developed, which can achieve up to 1500 MPa strength. A typical representative is the steel 22MnB5.

In order to achieve the required mechanical properties, the final structure has to be mainly composed of martensite without a significant presence of other phases. Therefore, for further development of the technological processes of the hot stamping process it is necessary to know all the phenomena accompanying the transformations of the structure during cooling in the tool. Important parameters are not only accurate temperatures of individual phase transformations, but also a range of other processes, including transformation plasticity. This phenomenon occurs during transformation in a closed die when phase changes occur in most cases under stress. This stress causes the rearrangement of atoms during the transformation of the grid to energetically more favourable positions. This is reflected in the macroscopic scale as a change in dimensions, which at the same time causes a significant reduction of stress and thereby substantially eliminates spring-back effect. Despite the essential importance of this phenomenon for the hot stamping process, this phenomenon has not been sufficiently explored so far.

The experimental programme was carried out with 22MnB5 steel, commonly used for the hot stamping process. For sheet metal specimens, the influence of tensile and compression stress was identified, acting during phase transformations, on changes of expansion, and both in standard laboratory conditions used for dilatometer measurements when determining CCT diagrams and also in model processes corresponding to the real technology of the hot stamping process. The research was completed by metallographic analysis and hardness measurement.

PROCESSING OF BIOMIMETIC CALCIUM PHOSPHATE COATINGS ON ZIRCONIA ORAL IMPLANTS FOR IMPROVED COATING ADHESION

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Calcium phosphate (Ca-P) coatings on zirconia oral implants have a great potential to improve the osseointegration of already-existing ceramic implants, owing to their bioactive characteristics. A very promising approach to the preparation of Ca-P coatings is the so-called biomimetic method, which includes the immersion of the implant into a supersaturated Ca-P solution under physiological conditions. This method allows the synthesis of coatings with a good surface coverage of materials that have complex shapes and good control over the composition of the coating [1]. However, the conventional biomimetic method has some drawbacks, related to the relatively long time of the synthesis and, in particular, the poor adhesion of the coating to the substrate. The motivation for our study was to overcome these drawbacks and to develop a biomimetic procedure that would enable the rapid deposition of Ca-P coatings and to further improve the attachment of the coating to the substrate by thermal processing.

In the first part of our study we applied a two-step wet-chemical biomimetic procedure for the deposition of Ca-P coatings on zirconia ceramics [2]. The coatings were analyzed with electronic microscopy and infra-red spectroscopy. The deposited coating was 12 μm thick and composed of two morphologically and compositionally distinct layers, i.e., hydroxyapatite and octacalcium phosphate. The bond strength of the coating to the substrate was 1.8 MPa. In the second part of our study [3] our goal was to improve the adhesion of the prepared coating by applying thermal treatments. For this purpose the coated substrates were fired at 600 °C or 800 °C. The samples fired at 600 °C preserved the morphology of the initial coating, while the composition changed to the hydroxyapatite. The bond strength of such hydroxyapatite coatings was improved to 3.2 MPa. When the samples were fired at 800 °C, the coatings became denser and were composed of β-tricalcium phosphate (β-TCP). In addition, the bond strength of the coating was significantly increased and reached the value of 30 MPa.

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SYNTHESIS OF Al-BASED ALLOY WITH QUASICRYSTALS

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The aim of our research was the investigation of $Al_{94}Mn_2Be_2Cu_2$ alloy in which under certain conditions (sufficiently high cooling rate) the quasicrystalline i-phase formed, in addition to other crystalline phases. In recent years the quasicrystalline phases became interesting as an effective hardening microconstituent within the multiphase microstructure of some alloys[1,2,3]. An $Al_{94}Mn_2Be_2Cu_2$ alloy was made by melting and chill casting into round moulds of diameters of 2, 4, 6 and 10 mm. The aim was to pursue the different cooling rates in each individual mould and try to evaluate it with the model of heat transfer and comparie that with the literature data. By this the critical cooling rate for the formation of i-phase was estimated. Also the morphology, average fraction of i-phase and the average microchemical composition of the occurring phases were studied. Analyses were carried out with a help of several methods, like: LOM, SEM, EDS and computer software.

It was found that at cooling rates between 500 and 1350 K s^{-1} the i-phase formed rather than its crystalline approximant (H-phase). Mainly the i-phase was formed as the quasicrystalline eutectic (αAl + i-phase) in the form of needles. The length and the thickness of the needles grew with increasing distance from the sample edge or with the decreasing cooling rate. The fraction of the i-phase increased with the decreasing diameter. In the case of the cooling rate below 500 K s^{-1}, the i-phase did not form. Instead the competitive crystalline H phase appeared. In our case αAl, θ-Al_2Cu and H-phase were the only crystalline phases presented.

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SUPERPLASTIC DEFORMATION OF X7093 Al ALLOY

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A high strength X7093 Al alloy was used in this investigation. It is a powder metallurgy alloy with 9% Zn and minor additions of Zr and Ni. Contrary to the most of well-known 7xxx alloys, high temperature mechanical behaviour of this alloy was not extensively investigated. The objective of this paper was to characterize superplastic deformation of 7093 alloy at intermediate and low stresses. Also, the rate-controlling mechanisms governing superplastic deformation were discusses in terms of physicaly based mathematical models.

In order to obtain superplastic material, commercial as-received plate with thickness of 30 mm was subjected to conventional grain-refinement thermomechanical treatment typical for 7xxx alloys[1]: (i) solution treatment, (ii) overaging, (iii) warm rolling and, (iv)discontinuous recrystallizaton. It was resulted in pancake-shaped grains with average diameter of 11μm. To examine high-temperature mechanical behaviour, tensile test specimens were machined from the axis parallel to the rolling direction. Two kinds of tensile tests were conducted: (i) conventional stress-strain tests and, (ii) strain rate jump tests. All the tests were carried out in the range of 490 °C – 531 °C (±2°) and within the strain rates of $5x10^{-5}$ – $5x10^{-2}$ s^{-1}. Maximum tensile elongation was found to be 570 % at 517 °C and strain rate $7x10^{-3}$ s^{-1}. However, all specimens at 517 °C and 531 °C yielded elongations somewhat more than a 500 % in a broad spectrum of strain rates. It was ascribed to grain boundary sliding mechanism of deformation[2].

Apart the usual tensile test investigation, strain rate jump tests were used to calculate (i) strain rate sensitivity (*m*-factor, and it's counterpart – stress exponent *n*), (ii) activation energy for deformation (Q) and, (iii) threshold stress (σ_o). Analysis of above data suggests that deformation at intermediate stresses is rate-controlled by lattice diffusion. But, at low stresses, chemical diffusion is rate-controlling process. According to dislocation theory of superplasticity, it seams that deformation at intermediate stresses is rate-controlled by grain boundary dislocation climb, while the low stress deformation is governed by viscous glide. The climb and viscous glide are sequential processes and the slower one rate-controls the overall deformation.

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GRAPHENE AS SUBSTRATE FOR ORGANIC THIN FILMS

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Organic semiconductors offer the possibility to fabricate low-cost organic light emitting diodes (OLEDs) and solar cells. Due to the complexity and anisotropy of the molecular building blocks, novel growth mechanisms and rich self-organization phenomena can occur as found for the growth of the rod-like oligophenylene molecule parahexaphenyl (6P) on inorganic substrates [1]. On the other hand, the novel material graphene bears the potential to be used as transparent and flexible electrodes in such devices to replace the commonly used indium tin oxide. Thus, the investigation of the growth of organic molecules on graphene is an up-to-date research topic.

We demonstrated recently that 6P can be grown on Ir(111) supported graphene sheets in a layer by layer mode with lying molecular orientation like it is required for optoelectronic and photovoltaic applications [2]. As has been recorded by low-energy electron microscopy, the 6P islands nucleate at wrinkles in the graphene substrate but move away as entities from the nucleation sites in a later stage of growth [3]. The achieved growth mode demonstrates the potential of graphene as transparent and flexible electrode. At substrate temperatures above room temperature crystalline 6P needles form [4]. These structures are also obtained by hot-wall epitaxy on exfoliated graphene flakes as we demonstrated recently by atomic force microscopy (AFM).

The required robustness of the electrode material for device applications has been tested by AFM based dynamic plowing lithography in conjunction with conductive AFM and Kelvin probe force microscopy [5].

This work has been performed in collaboration with G. Hlawacek, Q. Shen, M. Kratzer, A. Pavitschit, C. Ganser (Leoben), F. S. Khokhar, R. van Gastel, B. Poelsema, (Enschede, NL), B. Vasić, A. Matković, U. Ralević, D. Jovanović, R. Gajić (Belgrade, Serbia), and has been supported by the FWF project S9707-N20, STW and FOM project 04PR2318 and the Serbian Ministry of Science under project # OI171005.

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IMPROVEMENT IN MECHANICAL PROPERTIES OF AN EXTRUDED AA6082 BY OPTIMIZING OF CHEMICAL COMPOSITION AND PROCESS PARAMETERS

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The aluminium alloy 6082 is used as a material for highly loaded construction parts, which means any improvement in its mechanical properties would be an advantage. The majority of approaches employed so far for increasing the mechanical properties only considered a small number of influential parameters and assumed that they were independent of each other. In contrast, in this investigation a simultaneous increase in the yield stress and ductility (elongation) was achieved by considering a larger number of influencing parameters. As a result, a database of mechanical properties, process parameters and chemical compositions for the hot extruded profiles was collected. Individual and spatial analyses using a CAE neural network were performed to determine the influences of the process parameters and the alloying elements, e.g., Mg, Si, Mn, Fe, Cr and Cu, on the mechanical properties. The results of the analyses provided a new view of their influences, and the possibility to increase the mechanical properties if the process parameters and the correlation between the chemical elements were closer to the optimum values. An extensive parametric study and analysis of the results revealed the following:

- While individual influencing parameters show (highly) nonlinear relationships with no clearly observable trends in many cases, the simultaneous analyses of many influential parameters reveal physically much clearer relationships.
- It was possible to indicate the areas of values of influential parameters with a positive influence on the obtained mechanical properties as well as the areas that should be avoided.
- The highest (e.g., peak/optimal) values for the elongation and yield stress do not coincide. Therefore, the optimal values for the elongation and yield stress cannot be obtained for the same values of ram speed and extrusion ratio, etc., and chemical composition.
- With the process parameters, i.e., furnace temperature around 730 °C, casting speed around 7.4 mm/s, ram speed around 15mm/s, extrusion ratio around 9 and number of extruding strands equal to 3, an increase of the yield stress and elongation was achieved.
- An additional improvement of the mechanical properties was achieved using a content of Mg around 0.62 %, Si around 1.02 %, Fe around 0.37 %, Mn around 0.50 %, Cu around 0.07 % and Cr around 0.05 %.
- Test alloys revealed that the improvement of both mechanical properties, i.e., yield stress and elongation, can be obtained simultaneously. The yield stress was increased by about 4 % (333 MPa) and the elongation was increased by about 13 %.
- Despite the optimization there is still a small scatter present that can be attributed to the uncertainties of the production process as well as to the inaccuracy associated with the measured parameters. In order to overcome such difficulties, more advanced approaches that look at different sources of uncertainties, in addition to the many influential parameters considered in this study, should be taken into account.
- A standard optimization cannot be effectively carried out because of the unreliability of the technological parameters and the uncertainty of ensuring the predetermined chemical composition.

In practice, the obtained values for the yield stress and the elongation confirmed the optimized values for the influential parameters as being correct, since a simultaneous increase of both properties was achieved.

NUMERICAL STUDY OF RAYLEIGH-BÉNARD NATURAL CONVECTION HEAT TRANSFER CHARACTERISTICS OF WATER BASED Au NANOFLUID

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Numerical analysis is performed to examine the heat transfer characteristics of water-Au nanofluids. The analysis uses a two-dimensional enclosure under Rayleigh-Bénard convection heat transfer conditions and considers a range of Rayleigh numbers. The enclosure was subjected to a constant and uniform temperature at the bottom wall, generating Rayleigh-Bénard convection flow. The upper wall is kept at a lower constant temperature, while the vertical walls are assumed to be adiabatic. The study has been carried out for the Rayleigh number in the range $10^2 \leq Ra \leq 10^5$, and for the Au nanoparticles' volume fraction range $0.00 \leq \varphi \leq 0.10$.

The governing equations of such a flow are solved with the standard finite-volume method and the hydrodynamic and thermal fields are coupled together using the Boussinesq approximation. Grid refinement study is performed in order to obtain the mesh independent results and to assess their numerical accuracy, while the numerical approach is validated with comparison of the present results with the results of other author authors.

Highly accurate numerical results are presented in the form of the mean Nusselt number and heat transfer enhancement. Contrary to what many authors mentioned, we showed in this work that, in the classical Rayleigh–Bénard configuration, just after the onset of convection, there is more heat transfer in the base fluid than in the nanofluid. For a fixed value of the fluid Rayleigh number, the nanofluid Rayleigh number decreases with the volume fraction of nanoparticles. Thus the nanoparticles delay the onset of convection.

NUMERICAL SIMULATION OF RADIATION HEAT TRANSFER FROM FORGING FURNACE TO INGOTS

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This paper gives a summary of research into radiation heat transfer during soaking of ingots in a forging furnace, which was conducted using finite element method (FEM)-based numerical simulation. The purpose of this research was to explore the impact of the layout of a work load of diverse ingots on formation of longitudinal cracks in their surface. In the production process, cast ingots cool down to about 600°C but no less than 500°C prior to primary forging. Ingots are then placed in a furnace at a temperature of 1100 – 1200 °C. This poses a question whether this thermal shock might be the cause of the cracks that later propagate during forging. The cracks probably form within a few minutes of charging. This is due to the temperature gradient that has the most severe impact on the ingot surface. The ingots were cast from 34CrNiMo6 steel. Numerical simulations in DEFORM and MSC.Marc/Mentat programs were used to analyse temperatures and stresses in the process.
Multiple simulation models were constructed to map this problem. The initial calculation was performed in 2D using a single ingot in the forging furnace. This pilot simulation provided promising results, which is why it was expanded and a 3D problem with more accurate input data was explored. The computational model was gradually expanded by adding more ingots. The actual layout and materials of ingots in the work load were monitored in the plant on client's premises for three months. The ingots to be monitored were selected by statistical analysis.

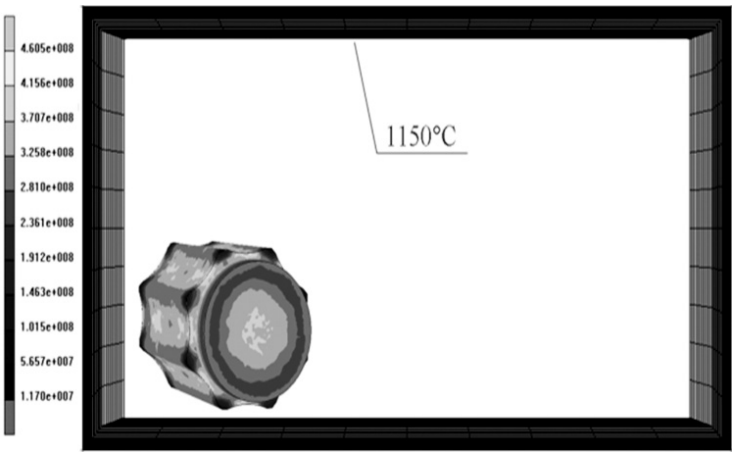

Fig. Stress distribution in the monitored ingot after 5 minutes

The materials model for the simulation was obtained from hardness test data through calculation in JMatPro software.
The calculated stress magnitudes allow the formation of cracks in an ingot to be predicted. Results of the analysis were used by the company PILSEN STEEL for adjusting the soaking procedure in order to minimize the risk of cracking due to thermal shock.

SIMULATION OF THE CASTING AND QUENCHING PROCESS OF A LABORATORY AlSi7MgCu05 CASTING

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In many high temperature applications, the lack of thermomechanical fatigue resistance of materials limits the lifetime of engineering components[1]. This is also true for the thermally high loaded diesel engine cylinder head. It is known that hardenable aluminium alloys start to diminish in mechanical strength at 150 to 200 °C and that the mechanical properties of cast aluminium alloys are strongly influenced by the metallurgical and microstructural properties[1]. In this work an aluminium step plate is used as a simplified casting geometry. The presented investigations are part of a multi-physics approach to simulate the whole production process of an industrial AlSi7MgCu05 casting. The long-term goal is the optimization of the production process and the prediction of mechanical properties of a diesel engine cylinder head. As the mechanical properties of the AlSi7MgCu05 alloy can be greatly improved by a heat treatment process[2], we present in this work a methodology to simulate the quenching process, taking into account the buoyancy-induced flow around the quenched part as well as the formation of the vapour phase in the quenching media. The CFD model is implemented by means of the CFD software ANSYS (FLUENT). We present a methodology to transfer mesh and result data from the casting software MAGMA5 to a CFD code (e.g. FLUENT) based on a conversion into the well-documented CFD General Notation System (CGNS) format. The temperature distribution in the casting is verified experimentally.

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ANOMALOUS ENHANCEMENT OF THE THERMOELECTRIC FIGURE OF MERIT BY CO-DOPING OF V IN Nb-$SrTiO_3$

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The effect of V co-doping of Nb-$SrTiO_3$ is studied by full-potential density functional theory. We obtain a stronger increase of the carrier density for V than for Nb dopants. While in Nb-$SrTiO_3$ a high carrier density counteracts a high thermoelectric figure of merit, the trend is inverted by V co-doping. The mechanism leading to this behavior is explained in terms of a local spin-polarization introduced by the V ions. Our results indicate that magnetic co-doping can be a prominent tool for improving the thermoelectric figure of merit.

CORROSION AND MECHANICAL PROPERTIES OF WELDED ALUMINIUM AND MAGNESIUM ALLOYS FOR REFRIGERATION COMPRESSORS IN COMPARISON WITH DEEP-DRAWING STEEL

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Increasing the energy efficiency of household refrigeration appliances is as a result of legal requirements more and more important (2010/30/EUEG2010 Directive). This means equipment with an energy efficiency lower than D, cannot longer find the way in the European trading. In this investigation Aluminium alloys (AW5083-O, AW6181-T4) and Magnesium alloy (AZ31-B) was selected via a material selection. They are compared to the currently used deep-drawing steels (DD11, DD13) with respect to the corrosion and strength properties of similar overlap welded joints.

To verify the corrosion properties a neutral salt spray test (NSS) and the fruit acid test were performed with an overall test duration of 480 hours. The type of corrosion and their influence on the corrosion rate and the strength of the welded joints were evaluated.

Magnesium shows very high corrosion and therefore cannot be used uncoated, like deep-drawing steel. The aluminium alloys show only slight selective corrosion phenomena and are from welding and corrosion point of view an attractive alternative for steel. Due to the higher thermal conductivity of aluminium compared to steel a higher energy efficiency of the cooling compressor is expected.

INFLUENCE OF THE ELECTRODE GEOMETRY OF A Co-PLANAR CAPACITOR ON THE ACCURACY OF THE MEASURED MW DIELECTRIC PROPERTIES OF $Na_{0.5}Bi_{0.5}TiO_3$-$NaTaO_3$ THIN FILMS

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$Na_{0.5}Bi_{0.5}TiO_3$–$NaTaO_3$ (NBT-NTa) thin films were synthesized using the sol-gel method and deposited by spin coating onto corundum substrates. Well-crystallized films were obtained at relatively low temperatures. The structural and surface morphologies were observed to be very sensitive to the preparation routine.

The MW dielectric properties of the thin films were determined with a spilt-post dielectric resonator system, which provides data about the thin film at one frequency, as well as with a planar-capacitor measurement configuration, which provides MW data over the whole microwave-frequency region. The co-planar interdigital electrode structure must satisfy the following conditions: 1) no resonance in the measuring frequency range, 2) impedance matching at 50 Ω, and 3) matching of the electrode size to that of the probe used for connecting the coaxial cables to the electrode. In addition, the measuring capacitance must be within the range $0.03\ pF \leq C \leq 3\ pF$. The measuring capacitance can be varied by interdigital electrode structures, which influences the accuracy of the measuring data. Therefore, in this presentation we will discuss the combination of the analytical and numerical modeling for co-planar interdigital electrode structures to characterize the dielectric properties of the $Na_{0.5}Bi_{0.5}TiO_3$-$NaTaO_3$ thin films. The co-planar interdigital electrode structures were prepared using E-beam lithography.

THERMAL ANALYSIS OF AlCu5.5 ALLOY WITH Nd

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The effect of Nd addition on the alloy AlCu5.5 was investigated using thermal analysis, differential scanning calorimetry (DSC) and scanning electron microscopy (SEM) to identify the generated microstructures. The purpose of this study was to analyze the influence of Nd addition to the eutectic Al_2Cu-phase from thermodynamic point of view. The results show that addition of neodymium increased eutectic solidification temperature (α_{Al} + Al_2Cu), which lead to a narrower solidification interval. On the DSC curves the heat peak for the formation of Al_2Cu phase get smaller with increasing Nd addition and finally disappeared when 5 wt. % of Nd was added. It was also discovered that neodymium formed binary eutectic (α_{Al} + Al_8Cu_4Nd) which was also confirmed using X-ray spectroscopy.

HYDROXYAPATITE AS BIO-SOURCED SEMICONDUCTOR APPLICABLE FOR SELF-CLEANING

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Hydroxyapatite (HAp) has long been used for the reparation and reconstruction of bone tissues which is the main field of its application. It is a natural-sourced bioceramic with interesting surface properties including hydrophilic nature, very good affinity for adsorption of various macromolecules (including proteins and nucleic acids) and high density of surface polar groups. These properties are the source of good bioactivity, ossteoconductivity and biocompatibility of the HAp [1]. Concerning the electronic structure, the material is wide-band gap semiconductor that can be activated by UV light for photocatalytic activity and ability for degradation of pollutant, non-degradable molecules [2]. Besides its applicability in regenerative medicine, there is a significant, less-exploited potential for biomedical application of this material for providing a self-cleaning of the surfaces used in biomedicine.
Recently, a novel material formed of HAp bioceramic and platinum (Pt) metallic components has been developed [3]. Here we present major physicochemical properties of the material as well as its capability for UV/Vis-activated photoactivity. The composite contains HAp plate-like particles with Pt nanoparticles (up to 10 nm in size) and Pt-ions attached onto HAp surface. Pt-components provided change of the optical properties of HAp within HAp/Pt composite and allowed its photoactivation. Resultant material has potential for strong photocatalytic activity that can be activated by both, UV and Vis light. Due to the special electronic structure and ability for electron-storage, material has potential for extended activity during the period when it is kept in the dark. In comparison with commercially-available P25 photocatalyst (a mixture of rutile and anatase TiO_2), the material developed in our lab has more than three times higher rate constant for degradation of methylene blue used as a model of non-biodegradable dye. Mechanism of the UV/Vis activity of the material and potential fields of its application are going to be discussed.

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INFLUENCE OF THE ROLLING LOADS ON THE STRESS IN THE ROLL SURFACE LAYER

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The roll surface is periodically loaded by thermally and mechanically inducted stresses during rolling. This leads to thermal fatigue, wear, corrosion and contact fatigue. This paper describes the processes of roll cooling simulation and verification of the structural damage of the roll surface layer with a focus on the influence of the rolling loads. The most critical factor for the thermal cracks is a tensile stress which appeared in the roll surface layer in the cooling area. In addition, the load like rolling pressure or shear stress can significantly decrease the product life of a roll through the facilitation of a thermal crack forming and propagation to roll core.

The distribution of the cooling around the roll influences the total heat balance and influences the intensity of the thermal cyclic stresses as well. Three different cooling configurations were created based on real hot strip mills. These configurations have the same cooling effect on the roll but they vary in cooling intensity and position from each other. The efficiency of the cooling configurations was examined. The determination of the conditions of surface layer during a rolling process is a goal to increasing the product life of the roll. We can design an optimal cooling configuration based on this knowledge.

The task can be divided into two parts – structural and thermal analysis. The thermal analysis is calculated first. It produces the thermal load in the roll body over time. The thermal load on the roll is used for the computation of stress fields on the roll in the structural analysis. The boundary conditions describing the cooling intensity are obtained from the laboratory measurements and from the measurement taken in rolling mills. Superposition of both loads, mechanical and thermal, provides information about stress-strain behaviour of the roll surface layer.

The optimized design of the cooling minimizes elastic, in some cases even plastic, deformation of the material and provides sufficient cooling in order to keep the rolls at a reasonable temperature. The efficiency of cooling was examined by total amount of the plastic strain produced during cooling, by the size and the shape of the stress-strain loop.

IRON SULPHIDES SYNTHESIZED BY CHEMICAL VAPOUR METHOD

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A small amount of copper was shown to induce twinning in natural crystals of pyrite [1]. In order to verify this hypothesis we prepared iron sulphides by chemical vapour transport (CVT) method using halides as transporting agents [2]. Equimolar parts of $FeCl_2$, and $FeBr_3$ precursors and small amount of $CuCl_2$ were heated in an evacuated quartz tube in a horizontal single-zone furnace. Vapour phase migrated through a sulphur trap within a temperature gradient from 600 to 550 °C for 72 hours. In high temperature zone iron halides reacts with sulphur and form up to 3 mm large simple hexagonal platelike crystals of pyrrhotite. Some of the iron halides are transported to the lower temperature zone at 550°C where they react with sulphur to produce pyrite and pyrrhotite, both nucleating from the vapour phase.

Pyrite crystals have a cubooctahedral morphology with a porous core and an unusual homoepitaxial overgrowth on cube and octahedral faces. In addition to pyrite, secondary crystallization of pyrrhotite in form of star-like twins is observed. A six-fold symmetry of the twins suggests an interpenetration twinning in basal {001} planes or 60° rotational twinning with the [001] twin axis and {110} prism planes as twin contact planes. EDS analysis, normalised to pyrite composition, indicates a slightly substoichiometric composition of Fe:S = 47: 53 for pyrrhotite, which suggests that pyrrhotite was formed instead of pyrite as a result of sulphur deficiency.

TEM study of twinned pyrrhotite revealed alternation of *ccp* and *hcp* sequences [3,4], coherently intergrown on a unit-cell scale [5]; *ccp* sequences are prevailing in the structure and may be the main cause of apparent twinning.

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CALCULATION OF ACTIVATION ENERGY FOR CREEP DEFORMATION OF STEEL WITH UNIFORM CARBIDE PARTICLES DISTRIBUTION

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Recent research shows a dependence of accelerated creep rate on carbide particle distribution in martensite, with creep rate depending on number of carbide particles per unit of surface and their mutual distance. However, equations used for creep rate calculation usually do not take into account the size and distribution of carbides, thus limiting the possibility of analyzing these effects. The aim of our work was to calculate the activation energy for different size of carbide particles and particle spacing, with modified equation for creep rate calculation for creep resistant steel 0.18C11.5Cr0.29V with microstructure of ferrite matrix and uniform distribution of $M_{23}C_6$ carbide particles. Creep rate calculation was performed for four different temperatures, 540 °C, 570 °C, 600 °C and 630 °C and for four different carbide particle sizes, 0.1 μm, 0.2 μm, 0.3 μm and 0.4 μm.

Results of this investigation show that calculated creep rate increases inversely proportional to the temperature, with the same effect of temperature on creep rate increase found for all 4 carbide particle sizes. Furthermore, independent on the carbide particles size and spacing, the creep activation energy of 248.7 kJ/mol was calculated. The calculated creep activation energy is close to self diffusion activation energy in α iron. These results indicate, that elements in solid solution in ferrite may have only a very limited effect on creep activation energy and that by increase of temperature, creep rate increase is slightly greater for coarser particles.

CHANGES IN MORPHOLOGY OF INCLUSIONS IN STEEL UNDER THE TOP SLAG (BASIC SLAG)

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Many authors deal with change of the chemical composition of inclusions after dosage of calcium by cored wire or through the top lance. This paper aims to focus on the issue, whether inclusions in steel change their morphology without addition of calcium. Evolution of inclusions under top slag is monitored in conditions of atmospheric pressure and vacuum. Change of the chemical composition of inclusions during processing is discussed and then a mechanism for the conversion of inclusions during processing is proposed. It follows from chemical composition of inclusions that in the course of treatment of steel under top slag (basic slag) in ladle furnace and particularly in vacuum a change of chemical composition of inclusions occurs. During this treatment average chemical composition of inclusions approaches chemical composition of the slag due to their mutual interaction at intensive contact of both phases in vacuum. Influence of top slag (basic slag) is significant particularly in the course of degassing of steel, which is caused by better kinetic conditions of contact of inclusions with slag drops in vacuum. On the surface of inclusions after degassing of steel under top slag (basic slag) and envelope is created, chemical composition of which approaches that of the ladle slag. The works was created within solution of the projects FR-TI2/280 and FR-TI1/477 under financial support of the Ministry of Industry and Trade of Czech Republic.

CLASSICAL MOLECULAR DYNAMICS SIMULATION OF PuO_2

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Nuclear fuels are generally tough materials to investigate. Radioactivity and toxicity are well known problems. Also it is hard to obtain an undamaged crystal structure because of extreme conditions like irradiation and temperature. Molecular dynamic simulation is a good way to demonstrate without these limitations. Plutonium dioxide (PuO_2) is a main compound of a mixed oxide (MOX) fuel. We have developed a new semi-empirical rigid ion potential to model interactions between ions. Here we investigate the evolution of nuclear fuel material, PuO_2 with temperature. Preliminary results are promising.

RECYCLED POLYMERS/CLAY COMPOSITES FOR HEAVY METALS ADSORPTION

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Post consumer plastics in form of disposable cutlery, plates, cups, and containers for dairy products that made of polystyrene (PS) were used to formulate polymer/clay composite material for the purpose of using it as adsorbent for heavy metals removal from waste water. Clay used in this study was a natural clay obtained from Tabuk region. The composites were formulated by mixing 5-10 wt% of clay with PS in the molten state using conventional polymer processing equipment. Composites of virgin PS and clay were also formulated in order to compare their ability to adsorb heavy metals with that of the recycled composites. The results have shown that composites based on recycled PS have good adsorption capability in comparison with those of the virgin composites. For example the amount of lead adsorbed per grams of adsorbent was tripled when using composites containing only 5 wt% of clay and 95 wt% recycled PS in comparison with those with virgin PS.

NITRIDING OF ALVAR14® HOT WORK TOOL STEEL

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In this study, the surface of Alvar14® hot work tool steel was modified by gas nitriding in a vacuum furnace at 560 °C for 4, 8 and 16 h, respectively. The effect of nitriding time on the properties of this steel was studied. The microstructure and morphology of the nitride layer formed on the steel sample were examined by SEM and the phases in that layer were determined by XRD analysis. Microhardness and the depth of nitriding layer were measured by Vicker's Indenter. The hardness of nitride layer ranged from 769 to 958 HV. Depending on the process time, the depth of diffusion layer changed between 155 and 310 μm as well as a little increase in thickness of compound layer. SEM studies and hardness distribution revealed that nitrided cross-section of sample has distinct regions, which are (i) compound layer, (ii) diffusion layer and (iii) matrix. Increasing in the process time, structures called as "white snakes" in the diffusion layer became more visible. Also, the coefficient of diffusion for this process was measured by the slope of "x^2-t" graphic was calculated as $1{,}814 \times 10^{-6}$ m^2/s.

CUTTING TOOL RECYCLING PROCESS BY ZINC MELT METHOD FOR OBTAINING THERMAL SPRAYING FEEDSTOCK POWDER (WC-Co)

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Various recycle processes of WC-Co cermets from the cutting tool materials, such as chemical modification, thermal modification, cold stream method and electrochemical method have been investigated and some of them are actually employed in industry. However, these conventional methods have many problems to be solved and they are not always established technologies. Therefore, we need to develop more economical and high-quality recycling procedure. In this study we investigated appliciability of the zinc melt method (ZMM) for recyling WC-Co as a powder from the high speed steel scraps. It proved that ZMM is an available technique for recovering WC powder from the cutting tools. WC-Co powders are recovered and then spray dried, sintered and obtained as feedstock material for thermal spray coating processes.

The powder microstructures and surface morphology were examined by scanning electron microscopy (SEM). Elemental distribution analysis in the recovered powder was conducted by the energy dispersive X-ray spectroscopy. The crystalline phases were identified by X-ray diffractometry. The density of the sintered body was measured in water by the Archimedes method. Flowability was measured by The Hall flowmeter. Particle size distribution was measured by Laser particle sizer.

INFLUENCE OF PROCESS PARAMETER ON THE CORROSION RESISTANCE OF CORRUGATED AUSTENITIC AND DUPLEX STAINLESS STEELS

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The main objective of this work is the study of the corrosion behavior of two hot-rolled and corrugated low-alloyed duplex stainless steels (DSS): UNS S32001 and UNS S32304. The UNS S32001 DSS presents an industrial novelty based on its composition, while the UNS S32304 DSS has just started to be used as concrete reinforcement. The results are compared to those obtained for corrugated AISI 304L austenitic stainless steel bars, manufactured in two rolling conditions (hot and cold).
Electrochemical measurements were carried out using polarization curves in a media simulating the solutions contained in the pores of the concrete. Microstructural analysis was performed by optical microscopy and scanning electron microscopy (SEM). It is observed that the morphology of attack is very different for samples subjected to non-carbonated media (pH $\approx$ 13) and carbonated (pH $\approx$ 9), both with NaCl (5 % by wt.).
The corrosion resistance of a given DSS depends on the percentage of NaCl and pH of the solution, varying with the type of steel and the processing method. The electrochemical parameters obtained from the polarization curves suggested that the UNS S32001 could be able to replace the traditional AISI 304L reinforcements thanks to its high corrosion resistance and economic advantages. The UNS S32304 showed superior performance to corrosion than AISI 304L, though it exhibits slightly higher costs than the austenitic grade.
The results demonstrated that the corrugated surface of all the bars was much more susceptible to corrosion than the core. Regarding 304L steel rebars the probability of corrosion and the morphology of the attack induced by anodic polarization varied significantly for hot-worked and cold-worked corrugated bars. Corrosion tests in both chloride containing alkaline solutions yielded to the conclusion that ferrite tended to corrode selectively in the UNS S32304, while the dissolved phase in the UNS S32001, was austenite. The duplex microstructure of the bars clearly influence on the development and morphology of the attack.

CHROMIUM OXIDES IN SLAG BY THE STEELMAKING OF STAINLESS STELLS IN EAF

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Equilibrium of chromium oxides (CrO_x) in metallurgical slag is very complex due to coexistence of multivalent Cr ions and high-temperature melting slags, which contain chromium. In non-stoichiometric amount of slag CrO_x depends on temperature, slag basicity and the content of chromium oxides in the system, which is in equilibrium with metallic chromium. Chromium oxide is distributed in the slag in the divalent and threevalent state. The activity of both CrO and CrO1.5 increases with increasing total content of CrO_x and basicity. In the slag with a higher activity the reduction of chromium from the slag back into the molten steel is greater. The CrOx solubility in the slag is small. Solid chromite are formed in the slag in the case of higher content of CrOx in the slag. Such slags are heterogeneous because solid chromite in liquid slag affects the slags metallurgical properties. If CrOx absorbed in the liquid part of slag, is at equilibrium and at sufficiently high content of silicon, chromium returns back to the molten steel. However, if chromium is present as solid phase in the form of spinel $MgCrO_4$, $CaCrO_4$ in the rigid slag, then the return of chromium into the melt bath is small. We analyzed the slag from electric arc furnace (EAF) during the manufacture of austenitic stainless steel grades.

SEGREGATION OF INTERMETALLIC PHASES IN FERRITE-AUSTENITE STAINLESS STEELS

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During hot working of duplex stainless steels, σ-phase and intermetallic phases precipitate, that can have a great influence on efficiency of hot deformation process. In this work influence of temperature and annealing time on precipitation of mentioned phases was studied. Experiments were performed on two stainless steels W.Nr. 1.4462 and 1.4162 (SAF 2205 and LDX 2101).

Hot rolled specimens and specimens annealed at different temperatures and different times were examined. Rolling was performed at temperatures from 800 °C to 1250 °C and annealed at temperatures from 700 °C to 1000 °C for different times, from 30 min up to 24 hours. The most suitable hot rolling temperature range and temperature ranges for precipitation of σ and other phases, that can cause problems during hot working process, were ascertained from the results. It was determined that at temperatures from 700 °C to 900 °C intermetallic phases like nitrides, chromium nitrides, vanadium carbonitrides and σ-phase start to precipitate on grain boundaries of tested stainless steels. These phases can cause cracks on the surface of the rolled steel during hot deformation of the steels at large deformations at temperatures below 1000 °C.

WEAR PROPERTIES OF AISI 4140 STEEL MODIFIED BY ELECTROLYTIC PLASMA TECHNOLOGY

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Within the past few years, a considerable interest has been developed in the field of surface treatment by plasma techniques in order to improve the hardness; wear resistance and corrosion resistance of materials. Recently, the working technology of high power density heat sources such as electron and laser beams and the novel technology electrolytic plasma treatment (EPT) have been developed rapidly and applied in surface hardening [1].

When hardening is not necessary for whole surface or bulk of material, EPT is a suitable method for treating a specific location on surface. Electrolytic plasma (heating-quenching) hardening is a special thermomechanical process employing, electrolysis in an aqueous solution under particular conditions, for instance voltage, current, electrolyte, duration, and heating-quenching rate. Heating or quenching of medium and high carbon steels can change their microstructure, which causes variations in the mechanical and physical properties and affects the behavior of the steels under service conditions and operations [2].

In this study, the wear resistance of Electrolytic Plasma modified AISI 4140 steel was evaluated under dry sliding conditions and compared with AISI 4140 steel samples. The modified samples were characterized before and after the wear test by metallographic, SEM microscopic, microhardness techniques. The test results indicate that the wear resistance of AISI 4140 steel can be improved by means of Electrolytic Plasma technology. The wear resistance increases with increasing layer hardness.

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EPOXY RESINS CURED WITH POLYTHIOURETHANE OLIGOMERS AS A NEW CLASS OF SUPPORTS FOR METAL-COMPLEX CATALYSTS

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Despite of the great industrial importance and common use of the polyurethanes, their sulfur analogs – polythiourethanes (polythiocarbamates) containing -NH-CO-S- moieties are relatively poorly investigated group of polymers. Still, there are only few known application areas of these polymers, for example: polythiourethane elastomers, thermosetting systems and nanocomposites including ZnS, CdS and PbS/polythiourethane with high refractive indexes and photocatalytic properties as potential materials for optical and medical applications.

In this work, we report the preparation and characteristics of mercaptan terminated polythiourethane oligomers synthesized through the reaction of multifunctional thiols and hexamethylene diisocyanate and their application as crosslinking agents for epoxy resins. Prepared polythiourethane hardeners give a perfectly homogeneous system with epoxy resin and have good storage stability in the presence of other coreactants like diamines. Polythiourethane-cured epoxy resins were characterized by excellent physicomechanical properties, thermal and chemical resistance. These features together with the presence of functional groups containing O, N, S donor atoms capable of coordinating to different metal ions, make them very interesting supports for the immobilization of transition metal-complex catalysts. We additionally presents, the results of our preliminary works addressed to the possibility of using polythiourethane-cured epoxides as carriers for palladium complex $PdCl_2(PhCN)_2$. The methods for preparation of the palladium catalysts supported on this new type of polymeric support and the catalytic properties of obtained catalytic systems in the model Heck reactions are presented.

PRODUCTION AND HEAT TREATMENT OF DUPLEX STAINLESS STEEL FORGINGS

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Development of Offshore oil and natural gas production requires seawater corrosion resisting materials. Duplex stainless steels represent a group of materials that show an interesting combination of strength properties and resistance to stress-corrosion cracking initiated by chlorides. The production of duplex stainless steel in ZDAS, Inc. includes basic metallurgical processes. For production of the liquid metal, the electric arc furnaces are used. The processing of liquid metal takes place in the secondary metallurgy equipment. For successful realization of heavy forgings made by open-die forging technology it is necessary to observe the specific conditions of forming and heat treatment. The achieved microstructure of duplex stainless steel then shows a uniform proportion of ferritic and austenitic grains without undesirable inter-metallic phases.

INNOVATIVE COATINGS FOR AIRCRAFTS STRUCTURES

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Today conventional titanium-based alloys represent one third of the weight of modern aircraft engines and, are the second most used engine material following Ni-based superalloys. [1] Modern high-pressure compressors employ near-α titanium alloys in the front and Ni-base superalloys in stages exceeding 500 °C. The improved trust to weight ratio of today's jet engines is in part a result of a higher stage pressure ratio of modern compressors in conjunction with higher mechanical loads, as well as significant weight reduction by replacing Ni-based alloys by last generation near-α titanium alloys. After 40 years of development of this class of material, the temperature capability is up to 550–600 °C and it seems to be an upper limit [1]. The work addresses in particular to aircraft engines applications (highpressure compressor blades and vanes, low-pressure turbine blades, turbocharger wheels and exhaust valves) but the results will offers a number of attractive features for use in high-production of automobiles. Titanium aluminide alloys based on intermetallic phases γ (TiAl) and α_2 (Ti_3Al) and the most recent – orthorhombic titanium aluminide, are widely recognized as having the potential to meet the design requirements for high temperature applications.

Coatings were made by different plasma jet techniques. Experimental studies are focused on electrochemical study of interfaces using electrochemical impedance spectroscopy and voltametric techniques for coating and for system -diffusion and thermal barriers.

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THE EFFECT OF BINDER ON CHEMICAL PRECIPITATED HYDROXYAPATITE DURING SPRAY DRYING

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Bone is formed by collagen fibres and hydroxyapatite. Hydroxyapatite is the main mineral component of mature bone with stoichiometric formula $Ca_{10}(PO_4)_6(OH)_2$ [1]. Hydroxyapatite (HA) is commonly applied to orthopedic devices to promote bone growth. For orthopedic applications, metals are often coated with hydroxyapatite (HA) to enhance the osteointegration of the implant [2]. The aim of this work was to produce hydroxyapatite powder with chemical precipitation method and reshape in spray dryer and investigate the effect of binder on powder structure. Ethanol, pure water and polyvinilalcohol (PVA) + ethanol were used as binder. Different parameters were used in Spray Dryer. When particle dimensions are reduced to the order of several nanometers, their physical and chemical properties deviate significantly from the bulk properties of such materials. However, due to their extremely small sizes, the particles suffer from many problems related to their surface and thermal stability, shape preservation, handling, assembly in devices, etc. It is therefore an important challenge to solve these problems by developing slightly larger particles (e. g. on the submicrometer scale) in which the properties generated by the nanoscale material are preserved [3]. So, the powder size and shape are very important to properties.
However, bacterial test was applied to natural hydroxyapatite and synthetic hydroxyapatite and E. Coli bacteria were used during test. Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), (EDX), X-ray fluorescence (XRF) and bacterial tests were used to characterize specimen powders.

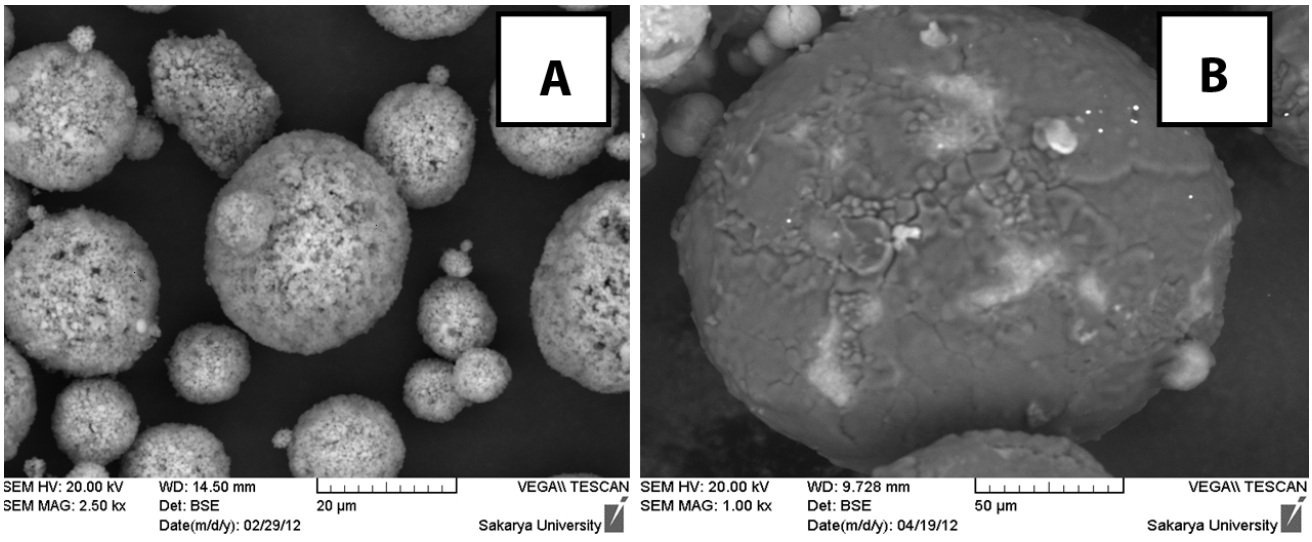

Figure 1. Hydroxyapatite powders' microstructure. a) with Ethanol binder 2,5kx, b) with pure water binder 1kx

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FREQUENCY-TEMPERATURE SUPERPOSITION IN RUBBERS

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Owing to chain-like macromolecular structure of polymers, rubbers in particular, any dynamic mechanical disturbance of the latter induces material response that depends, apart from interference magnitude, also on its rate, or the related duration. This is because the long rubber molecules require certain period of time to rearrange their conformations in order to undergo transition from one equilibrium state to another by the process known as relaxation. As such characteristic times may well protrude into macroscopic temporal domain, the imposed, say, deformational, frequencies are often too high (i.e. the corresponding times too short) for relaxation to be completed, which affects the material resistence to deformation through augmented internal friction. That is then reflected in mechanical dynamic properties, making the characteristic quantities, the storage and the loss moduli, depend on frequency. In view of how well the molecular conformational changes can follow the imposed frequency, rubbers experience several states associated with distinctive frequency zones, respectively named terminal, plateau, transition and glassy, together entailing the frequency range of many orders of magnitude (often up to 15). The experimental rheological characterization of the material by means of measured mechanical dynamic functions within such a wide frequency range may be exceedingly difficult, if not impossible.

More thorough examination of polymer dynamics shows, however, that the same effects may be caused by material temperature variation at constant frequency within easily attainable temperature range, thus creating equivalent states of, say, the one at low temperature corresponding to the other at high frequency, and vice versa. This phenomenon, generally called the frequency-temperature superposition principle, is mathematically described by the Williams-Landel-Ferry equation, enabling determination of rubber mechanical dynamic properties at arbitrary frequency by means of their dependence on temperature. Although established long ago, this principle still represents an active topic of theoretical and applied polymer physics.

The work presents the principle application in rubbers and their thermoset resin blends, along with its benefits and shortcomings.

EVALUATION OF SELECTED PROPERTIES OF A CVD COATED TOOL USED AT COLD FORMING PROCESS

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Along with technologies development rise demands on the technical level of new machinery and equipment and also the reliability and efficiency of tools used in the production processes.
One of the options for increasing tool life and wear resistance is the use of tools surface treatment technology called as CVD (chemical vapor deposition) process. Chemical vapor deposition is a widely used materials-processing. CVD is an atomistic surface modification process, where a thin solid coating is deposited on an underlying heated substrate via a chemical reaction from the vapor or gas phase.
Herein we introduce the capabilities of this process to the tool called "former" made of tungsten – molybdenum high speed steel type Böhler S 600. The former is used to produce the seamless steel reducers that are used as a part of steel distributors and pipelines, designed for distribution of different kinds of liquids and fluids medium.
The tool is evaluated in terms of coating thickness and microhardness of tool material and coating.

OPTIMIZATION OF OPTICAL OXYGEN SENSOR'S PROPERTIES BASED ON 4,7-DIPHENYL-1,10-PHENANTHROLINE RUTHENIUM(Ii) DICHLORIDE COMPLEX

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Optical oxygen sensors based on fluorescence of ruthenium complex are suitable for various applications[1]. Ruthenium (II) complexes are by far the most widely-used oxygen dyes within optical oxygen sensors. In general, they have efficient luminescence, relatively long-life metal-ligand charge-transfer excited states, fast response times, strong visible absorptions, large Stokes shifts, and high-photochemical stability[2,3].

Various concentrations of 4,7-diphenyl-1,10-phenanthroline ruthenium(II) dichloride complex (0.0017 mol/mL, 0.0034 mol/mL, 0.0051 mol/mL and 0.0068 mol/mL), different solvents (methyl-etylketone, toluene, chloroform, methanol), holders and silicons were used for sensor preparation. Several spin-coating procedures were tested in order to prepare homogeneous sensor surface. After that sensors were dried and exposed to various concentrations of oxygen (0-100 %) where intensity of fluorescence was finally detected. *Scanning electron microscopy (SEM) was also used for determination of sensor solution deposition.*

Spin-coating procedure could be used as an alternative method for application of sensor solution onto holders whereby it is difficult to prepare homogeneous layer on the whole sensor surface. In future work we intend to develop high precision mechanically apparatus for applying uniform and homogeneous thin layers for optical sensors.

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DEVELOPMENT OF ALLOY BOILER PLATES FOR HIGH TEMPERATURES USE

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Chromium-molybdenum alloy steel plates for welded boilers and pressure vessels are intended for use at elevated temperatures. They are usually used in petroleum, chemical and oil industry and in the industry for producing, transport and storage of gas.

The main alloying elements are molybdenum and chromium. According to the addition of chromium and molybdenum these steels are divided into different grades. We have developed various grades, which are: Grade 11 with 1 % chromuim, 0,5 % molybdenum and silicon addition, Grade 12 with 1 % chromuim and 0,5 % molybdenum, Grade 22 with 2 % chromium, Grade 5 with 5 % chromium and Grade 9 with 9 % Cr and 1 % Mo. The addition of chromium improves corrosion resistance and molybdenum improves resistance at elevated temperatures.

Plates of these steel grades must have high tensile and yield strength and maintain these properties even at longer holding at elevated temperatures. They must also have good weldability.

The technologies of continuous casting, hot processing and heat treatment of these steel grades were developed.

The technology of manufacturing and processing of these steel grades have been developed on the basis of experience with similar types of steels.

The prescribed mechanical properties are obtained by appropriate heat treatment. To ensure the final quality of the plates, laboratory heat treatment, metallographic analyses and the determination of phase transformations and phase contents were performed.

USE OF LOW-TEMPERATURE PLASMA FOR DISPOSAL OF ELECTRIC WASTE AND EVALUATION OF SUITABILITY

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Problems of electric and electronic devices whose lifetime have finished are a much discussed question abroad as well as in the Czech Republic during several recent years. Technical development in this field is continuously going forward very quickly. Majority of equipments and devices getting older only a little are replaced by new ones.

It is important to recycle electric and electronic equipment because of their material potential that finishes at stocks in many cases, in better cases these equipments are used as a resource of secondary raw materials.

If electric and electronic equipments are not used as resources of secondary raw materials, they will become a waste that must be disposed not to pile and influence unfavourably environment in this way. Waste use is connected with an economy because disposal costs are continuously rising.

Good knowledge of production technology, treatment as well as material characteristics of products are an important viewpoint for technically as well as economically efficient waste use. Especially in the field of development of new materials raw material composition changes and new kinds of wastes arise in this way. Separation of the individual kinds at the place of their origination and/or their subsequent sorting is the ground for raw material management even if the sorting costs are high.

Today electric waste is a waste, which is continuously discussed. The main reasons of this fact are possible dangerous components, material re-utilization and last but not least its disposal. When metals from scrapped electric and electronic devices are recycled the properties are the same, metal character does not change. The problem is with plastic parts, which essentially change their properties during further treatment. Assessment of availability connection of high-temperature pyrolysis and plasma is a method in research stage but first results are satisfactory.

ALUMOTHERMIC REDUCTION OF ILMENITE IN STEEL MELT

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Reduction of ilmenite ($FeO \cdot TiO_2$) and titania (TiO_2) with aluminium at the temperatures of steel melt was made. The results show that ilmenite reduction does take place while titania reduction does not. The alumothermic reduction products were metal phases that contain mostly aluminium, iron and titanium. Alloying of the steel melt with ilmenite was also preformed. The yield of titanium in comparison to alloying with ferrotitanium was a point of interest. The yield of titanium was 21%, which is less than the yield of ferrotitanium, with the yield of ferrotitanium production from ore included. The reaction mechanism of the reactions on the phase borders between aluminium, ilmenite and the steel melt was studied. It was determined that titanium dissolves into the steel melt though the formation of intermetal phases. The presence of titanium nitrides is undisputable evidence that titanium was alloyed in metal form and not as an oxide trapped in the melt.

MICRO-ABRASION WEAR TESTING OF MULTILAYER NANOCOMPOSITE TiAlSiN/TiSiN/TiAlN HARD COATINGS DEPOSITED ON AISI H11 STEEL

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Nanostructured hard coatings are widely used to improve the wear resistance of tool steels in tribological applications. Their layered or composite structure retards crack movement through coating thickness and prolongs the lifetime of the coatings. These coatings generally work under abrasive conditions and, therefore, determination of their wear behaviors has great importance. In this study, the free ball micro-scale abrasion test, based on the ball-crater technique, has been used to evaluate the wear resistance of multilayer nanocomposite TiAlSiN/TiSiN/TiAlN hard coatings. The coatings were deposited on AISI H11 cold work tool steel using industrial magnetron sputtering system CC800/9 sinOx ML (CemeCon). Microhardness of the coatings was measured by nanoindentation. The tests have been performed using SiC abrasive slurry by ball-cratering equipment. The crater wear have been measured using optical microscope and the wear rate was calculated. Analysis of the wear mechanisms developed was conducted by scanning electron microscope. It was found that multilayer nanocomposite TiAlSiN/TiSiN/TiAlN hard coating provided better micro-abrasive wear resistance than uncoated AISI H11 substrate.

THERMAL STORAGE AS A WAY TO ATTENUATE FLUID TEMPERATURE FLUCTUATIONS – SENSIBLE VS. LATENT HEAT STORAGE MATERIALS

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The maintaining of a constant fluid temperature is quite important in many applications. Some deviations from the desired fluid temperature can occur due to a number of reasons (imperfect temperature control, fluctuating heat load, etc.). Thermal storage is one of the ways to attenuate fluid temperature fluctuations.[1] Both sensible and latent heat storage materials can be used for this purpose. The behavior of sensible heat storage is rather independent of the time-average of fluid temperature (the same material can be used to attenuate temperature fluctuations at various time-average fluid temperatures). Another advantage of sensible heat storage is good thermal conductivity of many sensible storage materials, especially metals. Latent heat storage provides high thermal capacity in a rather narrow temperature interval (around the phase change temperature of a material); therefore, the material needs to be chosen with regard to the time-average value (usually the desired value) of the fluid temperature.[2] A theoretical study comprising numerical simulations has been conducted in order to investigate the behavior of sensible and latent heat storage for attenuation of fluid temperature fluctuations. The studied case was a rather simple one. It was a circular channel (through which the fluid flowed) surrounded by the thermal storage material, with the adiabatic boundary condition on the external side. Water was considered to be the fluid in all studied cases. The value of heat transfer coefficient was determined according to convective heat transfer correlations. Two sensible storage materials (copper and concrete) and two latent heat storage materials (paraffin and hydrated salt) were considered for thermal storage. The main goal of the investigations was to assess the thermal response of each variant under the same conditions. The length of the channel, the flow rate of water as well as the thickness of the heat storage layer were the same in all variants.

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GROWTH OF ZnO GRAINS UNDER THE INFLUENCE OF INVERSION BOUNDARIES WITH DIFFERENT CRYSTALLOGRAPHIC CONFIGURATIONS

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Inversion boundaries (IBs) are dopant-rich planar defects which form in basal-planes (0001) of the hexagonal ZnO structure and form during sintering of ZnO with the addition of specific IB-forming dopants. During sintering of ZnO with the addition of Sb_2O_3 or SnO_2, for example, the orientation of ZnO domains on both sides of the IB is with the fast-growing [0001] direction towards the IB, forming 'head-to-head' IBs. ZnO grains with this type of IBs initially grow exaggeratedly in the direction of the IB, which results in the development of composite ZnO(IB) grains. When these grains collide, they start to thicken according to the Ostwald ripening mechanism. Final grains are roundish and their size depends on the number of IB-nuclei (dopant concentration) in the initial composition.[1] On the other hand, small additions of TiO_2 or SiO_2 to ZnO result in the formation of 'tail-to-tail' IBs, where the [0001] direction of ZnO points away from the IB. In this case, initial fast growth is in the direction of the IB (exaggerated grain growth due to the IB-formation) and at the same time, the grains thicken in the perpendicular direction because the fastest growth direction of ZnO [0001] points away from the IB. This process results in coarse-grained ceramics with extremely large ZnO(IB) grains used for low-voltage applications. In this contribution, quantitative comparison of ZnO grain growth with both types of IBs using grain growth kinetic analysis will be presented.

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WEAR PROPERTIES OF PRODUCED CERAMIC BODIES WITH NATURAL ZEOLITE

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The aim of this study was to investigate wear properties of fabricated ceramic bodies with natural zeolite. Clinoptilolite which is a type of natural zeolite was used in studies. Samples were fired in an electric furnace with a heating rate of 10 °C/min at 1150 °C with a period of 60 minutes.
Zeolites used in the present study were supplied by ETİ Holding Company located in Turkey. The chemical composition of zeolite as raw material was given in Table 1. The XRD Pattern of zeolite is also shown in Figure 1. The raw material was ground and sieved to pass through -75 μm. Then, water was added as a binder and disc samples (ϕ = 25 mm, with 5 mm thick) were shaped by uniaxial dry pressing at pressing pressure of 1.5 tone. After shaping, samples were dried at 110 °C for 24 h in an oven. Dried samples were fired in an electric furnace with a heating rate of 10 °C/min at 1150 °C for a period of 60 minutes. Then, the fired samples were cooled down to room temperature in the furnace.

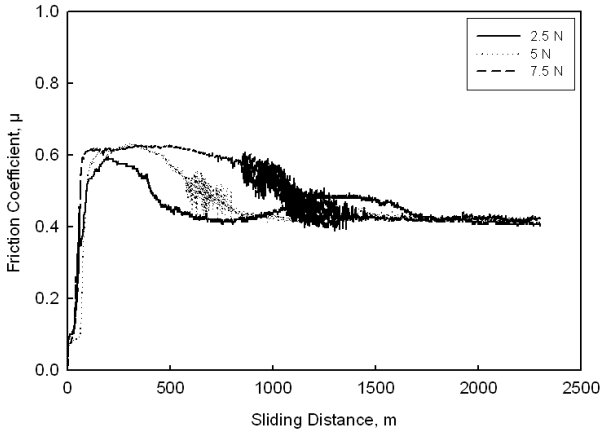

Figure 1: The friction coefficient of zeolit

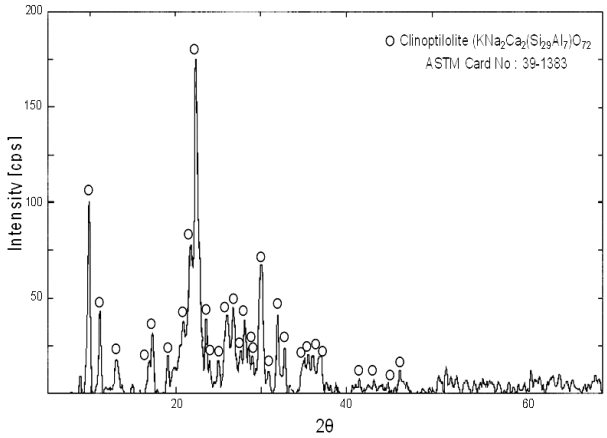

Figure 2: XRD Pattern of used zeolite

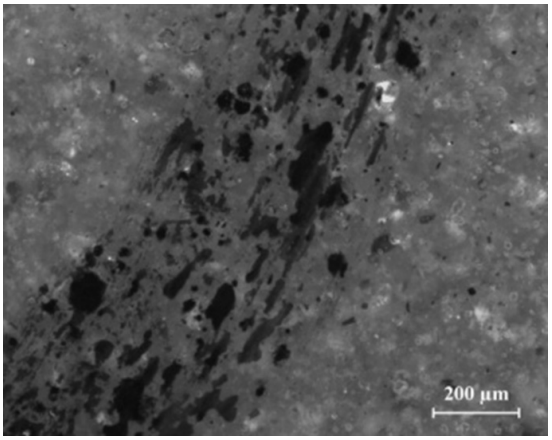

Figure 3: SEM of cross-section

NEW APPROACH TO EVALUATION OF CHEMICAL MICRO-HETEROGENEITY OF CONTINUOUSLY CAST STEEL SLAB

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The paper deals with new approach to measurement and evaluation of chemical micro-heterogeneity of elements in solidified poly-component metallic systems. Original approach is based on experimental measurements made on the samples taken from characteristic places of the casting and subsequent application of the original mathematical model for determination of distribution curves of dendritic segregation of the analysed elements, characterising the most probable distribution of concentration of element in the frame of dendrite, and original mathematical model for determination of effective partition coefficients of these elements in the structure of the analysed alloy.
The paper describes also application of this method at research of chemical heterogeneity on cross-section of CC steel slab and presents selected results (indices of heterogeneity and effective partition coefficients of seven analysed elements) characterising chemical micro-heterogeneity on one half of cross-section of this CC steel slab.
The following main results were obtained: (*i*) dendritic heterogeneity of accompanying elements and impurities is comparatively high; (*ii*) all the analysed elements segregate during solidification into an inter-dendritic melt, and their partition coefficient is smaller than one; (*iii*) the dendritic heterogeneity decreases in this order of elements: sulphur, aluminium, phosphor, titanium, silicon, chromium and manganese; (*iv*) the effective partition coefficients calculated in this new way inherently include in themselves both the effect of segregation in the course of alloy solidification, and the effect of homogenisation, occurring during the solidification, as well as during the cooling of an alloy.

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COMPARISON OF AN XPS AND AES RESULTS ON A THIN OXIDE LAYER ON DUPLEX STAINLESS STEEL

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Stainless steel is one of the most widely used materials and has many different applications. Duplex stainless steel (DSS) with a ferrite/austenite volume ratio of about 1:1 has been recognized as a good corrosion-resistant material in various aqueous environments [1].

The corrosion resistance originates from a Cr-rich oxide layer, which works as a barrier against ion diffusion between the alloy and the ambient phase [2-7]. Custom steel grades are designed for specific applications by optimizing their properties using specific alloy compositions. The alloy selected for this study was a 22 (wt.%) chromium, 5–6 wt.% nickel, 3 wt.% molybdenum, 2 wt.% manganese and nitrogen-alloyed duplex stainless steel (DSS 2205) (W.Nr. 1.4462) with high general localized, and stress corrosion-resistance properties, in addition to a high strength and an excellent impact toughness. This type of stainless steel is increasingly used because of its range of superior properties.

The aim of the present study is to investigate the initial phases of oxide growth on DSS 2205 as a function of the potentiostatic oxide in chloride-enriched solutions. The oxide layers were produced by the controlled exposure of polished duplex stainless-steel samples to a fixed potential. X-ray photoelectron spectroscopy (XPS) and Auger electron spectroscopy (AES) were used to measure the depth distributions of the oxide films formed on the surface by sputter depth profiling. To the best of our knowledge, this is the first report of the depth distribution and a comparison of the oxide layer compositions on DSS 2205 under the conditions specified in this paper.

The results obtained in the present work reveal that the passive film formed on the surface of the DSS 2205 in a chloride solution at pH 7 contains oxides of the two main elements, i.e., Fe and Cr. The oxides of the alloying elements Ni and Mo are negligible compared to the bulk, except for the increased Mo concentration in the transpassive region. A slight decrease in the chromium content close to the oxide/solution interface at higher anodic potentials was also observed. Molybdenum mainly enhances the effect of other passivating species, i.e., Cr, more than acting directly in the passivating process in chloride media, since its content in the oxide layer is minor. The formation of pits is observed. The size of the pits on AISI 304L is in the range of 1–3 mm, compared to AISI 204Cu where the pits size was up to 15 mm.

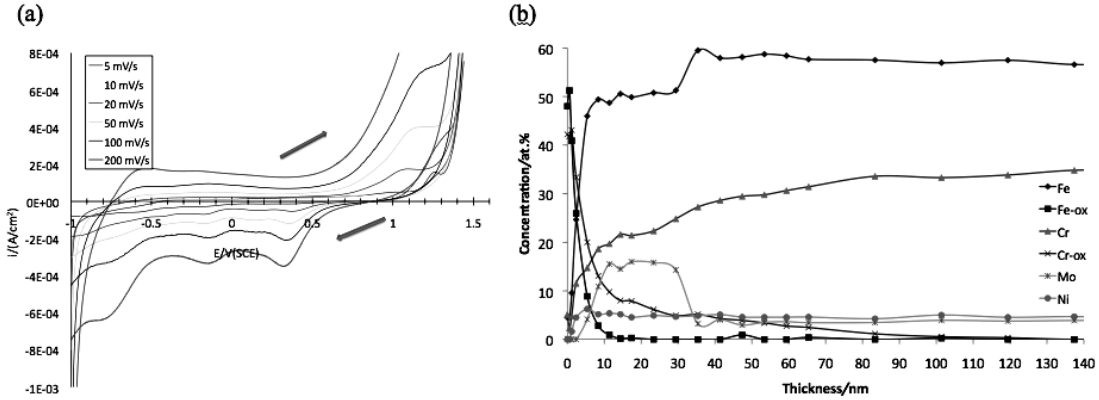

Figure 1: (a) Cyclic voltammograms recorded for DSS 2205 with an increasing scan rate in 0.9 % NaCl; (b) XPS depth profile of the sample oxidized in a 0.9 % NaCl solution at potential of 0.4 V (SCE).

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HRTEM STUDY OF TAAFFEITE CRYSTALS FROM MOGOK (MYANMAR)

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Taaffeite ($BeMg_3Al_8O_{16}$) and musgravite ($BeMg_2Al_6O_{12}$) are members of the Al-Mg-Be group of oxides. basic structural elements that are found in spinel ($MgAl_2O_4$) and chrysoberyl ($BeAl_2O_4$). Spinel (*s.g.* Fd–3m) has *ccp* arrangement of the oxygen sublattice along the ⟨111⟩ directions. In these directions, the structure is composed of alternating kagome (Al) and mixed (Mg and Al) layers, where the Al^{3+} ions occupy the octahedral and Mg^{2+} ions the tetrahedral sites (SICKAFUS *et al.* 1999). On the other hand, chrysoberyl ($BeAl_2O_4$) has a slightly distorted *hcp* stacking of the oxygen sublattice along the [0001] direction (*s.g.* Pnm) with Al^{3+} and Be^{2+} ions located in the corresponding octahedral or tetrahedral interstices (TABATA *et al.* 1974). A recent study of (111) twins of spinel (DANEU *et al.* 2007) revealed that the stacking across the twin boundary is hexagonal (*hcp*) and Mg^{2+} near the boundary tetrahedral sites are locally replaced by Be^{2+}. This indicates that Be^{2+} in fact causes the hexagonal stacking fault in an otherwise perfect cubic structure.

In the present work, the structure of different taaffeite crystals from Mogok was studied by X-ray powder diffraction (XRD), electron diffraction (ED) and high-resolution transmission electron microscopy (HRTEM). XRD analysis confirmed that the samples correspond to taaffeite ($BeMg_3Al_8O_{16}$). The structure of natural taaffeite-group minerals will be compared to samples, synthetically prepared from flux.

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EFFECT OF ABRASIVE GRAIN SIZE ON WEAR BEHAVIOR OF CERAMIC COATINGS BY MICRO-ABRASION TEST

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Micro-abrasion tests are commonly used to perform wear tests on hard coatings. In this study, AISI 1040 mild-steel specimens were coated with ceramic coatings including oxides with different hardness values. The free-ball micro-abrasion testing method was used to examine the wear behavior of ceramic surfaces in different test durations. Coating hardness measurements were fulfilled by micro-hardness tester. In experimental studies, the SiC abrasive particles in which three different grain sizes (800, 1000 and 1200 mesh) were used to explore the effect of abrasive particle size on wear ratio of ceramic coatings. The abrasive effect of the SiC particles was evaluated by examining the SEM micrographs of coating surfaces. According to the test results, the sample surface coated with Cr_2O_3 exhibited higher wear resistances than those of Al_2O_3 and its compositions with TiO_2. It can also be concluded from the results that an increase in the percentage of TiO_2 powders in the mixture of Al_2O_3 leads to a decrease in wear resistance.

THE CHARACTERIZATION OF Al_2O_3-TiB_2 COMPOSITES PRODUCED BY REDUCTION COMBUSTION SYNTHESIS

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Reduction (thermite type) combustion synthesis combines the metallothermic reduction of the elements from their oxides and subsequent reaction between the reduced elements. Thermite mixture of Al-TiO_2-B_2O_3 was incorporated with the Ti-B combustion system to produce in situ composites of TiB_2-Al_2O_3. Moreover, combination of Al_2O_3 to TiB_2 further improves its oxidation resistance, fracture toughness, flexural strength, and impact resistance [1,2]. In the present study, Al-TiO_2-B_2O_3 powder mixtures were used as starting powders. Al_2O_3-TiB_2 composite was manufactured in an electrical resistance furnace in the open air under the uniaxial pressure of 150 MPa at 1200°C for 4 hours, using reduction combustion synthesis technique. TiB_2, Al_2O_3 and some trace phases were determined in the produced composites by x-ray diffraction analysis (Fig.1a). The microstructure of samples was studied by scanning electron microscopy (Fig.1b) The relative density of samples measured by Archimedes' method with a 0.0001gr sensitive balance was determined as 94.2% and the hardness of composites was about 1832±496$HV_{0.1}$. In addition, the oxidation properties of this composite was studied in the open atmosphere at 600°C, 800°C and 1000°C for 4, 16, 32 and 64h. The calculated activation energy for oxidized process was found to be 90kJ/mol for composites.

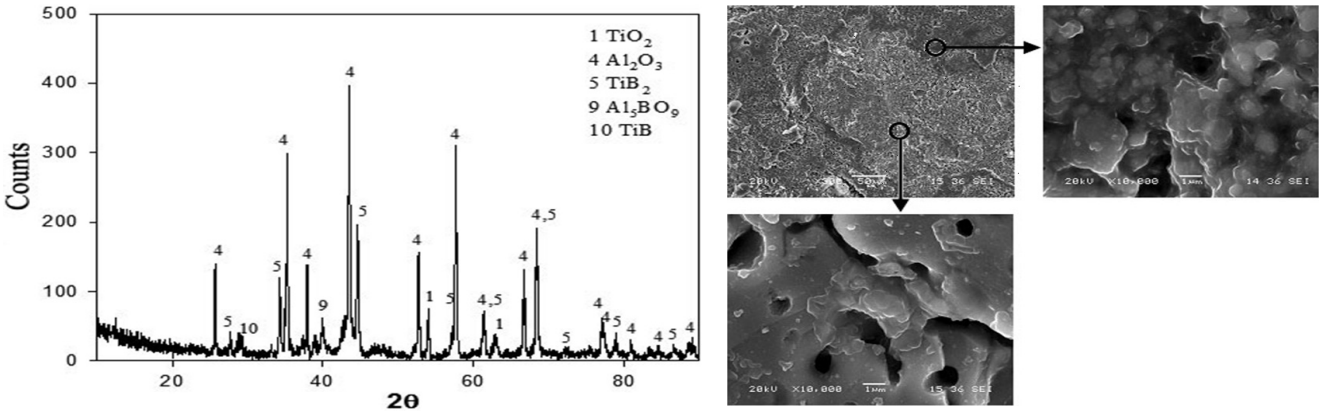

Figure 1. SEM micrograph and XRD diffraction patterns of sample synthesized at 1200 °C for 4h.

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IMPACT ABSORBER OF ALUMINIUM FOAM FOR RAILWAY CARRIAGES

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Aluminium foam is well known for its very good absorption ability of impact energy. In this paper a new application of aluminium foam ALULIGHT® for impact absorber will be presented. In this case the aluminium foam part is a subpart of crash absorbing system used for enhancement of passive safety in railway carriages. The aluminium foam part is made of heat treatable aluminium alloy; for better deformation behavior it has got optimized 3-dimensional shape, arrangement of porous structure and heat treatment. The 3-D shape is foamed in one step and the part has got dense surface skin. The part is an individual part in the assembly. It is not placed in any hollow profile or tube and contains no steel or aluminium reinforcements (nets, tubes, profiles) and adhesives. Recently, this part is being assembled in railway carriages of two worldwide companies.

BIOACTIVE GLASS SCAFFOLDS FOR BONE REPAIR

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Nowadays the elderly population is outliving their body parts, bones included. The surgical medicine mostly uses the techniques to transplant, repair or support tissue, but not to regenerate it. Bone is a living tissue and can regenerate itself if the defect is small. When the defect is larger, a support of stimulating framework is needed. Porous scaffolds have been developed in many forms and variety of biomaterials, including synthetic polymers, ceramics and natural polymers, but few reached the need of adequate physical, biological and mechanical properties.

Bioactive glasses are known for their stimulating effect on the body's regenerative mechanism and therefore they attracted a lot of attention in biomaterials as well as biomedical sciences. They appeared as one of the most promising template material for bone regeneration. However, there are still many open questions with regard to their use as scaffolds. Among them is low strength, which during degradation in biological environment even decreases. In addition, the rate of biodegradation and the resulting pH change are the parameters that need further consideration, as they may affect the ability of the scaffold to support the newly formed bone without potential negative effects.

In our work, bioactive glass samples were prepared by consolidation and sintering of nanoparticulate bioactive glass powder synthesized by sol-gel technique. The effects of microstructure and crystallinity on pH change during dissolution in water were analyzed and the formation of hydroxyapatite in simulated body fluid were observed as a function of time. In addition, the change in mechanical strength during degradation was observed. The results will be discussed in terms of the proposed behavior of the bioactive glass scaffolds during bone regeneration.

PERFORMANCE TESTING OF AN OPTICAL GROUND WIRE COMPOSITES DESIGNED AND MANUFACTURED FOR TRANSMISSION LINES AND TELECOMMUNICATION SYSTEMS

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In this study, background of optical ground wire (OPGW) composed of different materials has been presented in details to show progression of type testing before delivering the product to the communication and electrical energy transferring market. Performance level of the constructed composite structure reasons some differences than a product which is manufactured unique material. Therefore, to measure whether OPGW has reached required quality for approval, OPGW was exposed to several tests simulating real working conditions to detect behaviors of composite structure. These are stress-strain/fibre strain and tensile, aeolian vibration, galloping, creep, short circuit, shave, crunch, temperature cycling, water ingress and lightning tests. Thus, technical story of OPGW from the design to service environment was explained and test results interpreted Remedies due to failures of the composite conductor (OPGW) under heavy test conditions, required material improvements were also explained to reach approval.

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SYNTHESIS AND CHARACTERIZATION OF CHITOSAN COATED MAGNETIC NANOPARTICLES PREPARED BY DIFFERENT METHODS

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In this study, magnetic maghemite nanoparticles were prepared by the coprecipitation method[1], due to its simplicity and productivity. Thereafter, chitosan coated magnetic nanoparticles were synthesized by three different methods, by microemulsion process[2], suspension cross-linking technique[3] and covalent binding[4]. Subsequently the comparison of the used methods were done with various analyses such as Fourier transform infrared spectroscopy (FTIR), scanning electron microscope (SEM), energy dispersive spectrometer (EDS), thermogravimetric analysis (TGA), differential scanning calorimetry analysis (DSC) and vibrating sample magnetometer (VSM). Characterization results from Fourier transform infrared (FTIR) spectroscopy and thermogravimetric analysis (TGA) indicated the successful binding of chitosan on magnetic nanoparticles. SEM pictures showed that spherical structured particles with increased particle size were obtained as the chitosan layer around the particles was increased. Considering that the magnetic separation technique possesses the advantages of rapidity, high efficiency, cost-effectiveness, and lack of negative effect on biological activity, these carriers may hold potential applications in enzyme immobilization.

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THE CONTROL OF MICROSTRUCTURE OF ICDP IRON USING THERMAL ANALYSIS

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ICDP (Indefinite Child Double Pour) irons designated for working layer of centrifugal rolls of rolling mill must have precisely defined properties. The monitored parameters of the ICDP irons are: chemical composition, the amount of graphite in a microstructure and hardness of base metal material. Precipitation of graphite in ICDP iron with ledeburitic basic metal compound is a complex process that can be controlled and managed with the usage of thermal analysis. On the basis of the evaluation of cooling curve parameters of ICDP iron there is performed metallurgical adjustment of melting by adding elements supporting graphite or carbide formation into ICDP iron. The identified structural and mechanical properties of ICDP irons were correlated with recorded cooling curve. Subsequently, a methodology for control of the metallurgical adjustment of ICDP iron before tapping and pouring was proposed to ensure the desired microstructure and properties the ICDP iron.
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CHARACTERIZATION OF Cu-Cr-Zr ALLOY SYNTHESESED BY POWDER METALLURGY TECHNIQUE

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Age hardenable Cu-Cr-Zr alloys are widely used for many applications such as trolley wire, electrode for resistance welding and lead frame materials owing to their high strength, high electrical and thermal conductivity. Generally, manufacturing processing of Cu-Cr-Zr alloys includes casting, hot rolling, solution-treatment, water-quenching, cold deformation and aging steps, respectively [1,2]. In the present study, Cu – 1.5 wt.% Cr – 0.5 wt.% Zr alloy was prepared by powder metallurgy (PM) method and conventional atmospheric sintering. For this aim, Cu-Cr-Zr powders were pressed under 390 MPa uniaxial compression and sintered at 1000°C for 2h. After the holding time, samples were immediately taken out of furnace and pressed at 850 MPa. Sintered samples were solution-treated at 1000 °C for 15 min and water-quenched. Then, they were deformed 20 % at room temperature and aged at 470 °C for 2, 4, 6 and 8 h. SEM investigation revealed that, Cr and Zr particles having limited solubility in the Cu distributed homogeneously in copper matrix. XRD analysis showed that each sample (sintered and aged at 470 °C for different times) has same phases: copper and trace Cr_2O_3. The relative density of sintered sample having 92 % raised to 96% by cold deformation. Microhardness of samples ranged from 77 HV for solution-treated and water-quenched sample to 116 HV for aged sample (Table 1). It was observed that the longer aging time the higher hardness. As well as, electrical conductivity of samples increased from 76 %IACS for sintered sample to 86 % IACS for sample aged for 8 h. It was found that the electrical conductivity of specimens is similar that of Cu-Cr-Zr alloys produced by casting method [3,4].

Table 1. Variation of relative density, hardness and electrical conductivity of test materials as a function of process

Sample	Process	Relative Density, %	Hardness, HV	Electrical Conductivity, % IACS	
Cu-Cr-Zr	Sintered and hot-pressed	91,9	123	76	
	Solution-treated and water-quenched	92,2	77	77	
	Cold Pressed and Aged (470°C)	Time, h			
		2	94,5	86	85
		4	95,5	96	85
		6	95,3	98	86
		8	96,2	116	87

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THERMAL MONITORING FOR REAL TIME TBC FAILURE ESTIMATION DURING THERMAL CYCLE TESTS

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Thickness and micro-structural characteristics play a vital role in determining the quality of TBCs. During the long term services, stress concentration, which is caused by thickness variation, pores and cracks stemmed from improper parameter setup or operations lead to the delamination and spallation of the YSZ top coat from bond coat. Therefore, it is important to develop a non-destructive evaluation (NDE) method to measure the thickness and characterize the microstructure change. the relationship between the microstructure of TBCs and its thermal properties that affects the temperature distribution of the surface was investigated for providing the relevant knowledge. In this study, thermal monitoring was used to evaluate the durability evolution of TBC.

DEVELOPMENT OF TECHNOLOGY FOR PROCESSING NICKEL SUPER ALLOYS

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The processing of slabs of nickel super alloys NY825 and NY 625 in to cold-rolled coils proves that we can process the most demanding types of alloys in-to cold rolled coils with the existing technology park.
These two alloys belong to a group of nickel superalloys. Conditions of hot working are highly specific and the developed processing operation very complex.
It is important, that in a narrow temperature range, a sufficient degree of reduction entered the material, which initiates recrystallization processes, resulting in the formation of additional internal heat which enables rolling of these alloys.
At the same time we also used the narrower widths of slabs, which is not standard for our established production. Thus it was necessary to fully adapt and develop hot-and cold-rolling conditions.
In the world this type of processing in regular production is carried out only from the billets, which are rolled into bars or in very narrow strips.
Processing of these two types of nickel alloys is a major technological advance that has to be evaluated together with the high-end added value, which is represented by these products.

SYNTHESIS AND CHARACTERISATION OF Ti-SITE DOPED SrTiO3 and Sr- and Ti-SITE DOPED LAYERED PEROVSKITE $SrO(SrTiO_3)_N$ (N=1,2,3…) AS A N-TYPE THERMOELECTRIC MATERIAL

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Since the discovery of the thermoelectric effect in the 1821 by T.J. Seebeck, many potential thermoelectric materials have been extensively studied. Although the heavy based materials, such as bismuth telluride, silicon germanium alloys and bismuth antimonite exhibit applicable figures of merit at room temperature, they are usually not stable at temperatures higher than 500 °C. On the other hand, the high temperature stable metal oxide materials, in spite of improvements in the past decades, still achieve low efficiencies. Among metal oxide materials with promising thermoelectric properties at high temperature the most promising materials are layered p-type cobaltites and n-type oxides, such as ZnO and some perovskites (e.g. $SrTiO_3$[1], $BaTiO_3$[2], $CaMnO_3$[3]).

In our work we focused on the synthesis and characterization of doped $SrTiO_3$ and doped Ruddlesden Popper layered phases (RP) $SrO(SrTiO_3)_n$ (n=1,2,3…). The aim is to lower the thermal conductivity without lowering the electrical conductivity. In nonstoichometric RP phases this can be achieved through more or less ordered planar faults with a rock salt type structure. Nb-doped $SrTiO_3$ and Nb-doped $Sr_3Ti_2O_7$ and $Sr_4Ti_3O_{10}$ were synthesized via the solid state method and were analyzed with x-ray diffraction and electron microscopy. Results showed that the materials were more or less one phase materials with minor secondary phases present and that the microstructure was isotropic. Using the hydrothermal synthesis of doped RP phases we expect to obtain anisotropically shaped particles that will be used to prepare bulk materials with anisotropic microstructure and consequently better thermoelectric properties.

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ALIGNMENT OF PLASMID DNA MOLECULES BY OXYGEN PLASMA

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In the past few years plasmid DNA (pDNA) has been extensively studied for possible application in gene therapy, DNA vaccination [1] as well as for nanoscaled electronics [2]. For applications in the therapeutic purposes supercoiled form of pDNA is the most appropriate as it is the most stable one. While for application in electronic devices self-alignment of DNA molecules is desired. The objective of our work was to observe conformational state of pDNA molecules by atomic force microscopy (AFM) on differently treated substrates. In order to achieve self-alignment of pDNA molecules on atomically flat mica substrate the radiofrequency oxygen plasma was employed. Freshly cleaved mica was exposed to oxygen plasma for different treatment times and incubated with pDNA. Results from XPS analysis confirmed that functionalization of mica with oxygen functional groups is achieved already after 1 s of plasma treatment. The studies done by AFM indeed revealed different conformational state of pDNA molecules before and after plasma treatment. It was shown that appropriate treatment time of mica substrate by oxygen plasma enables self-alignment of pDNA molecules and could be employed for producing nano-scaled electronic devices made from pDNA.

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EVALUATION OF COAL CHARGE EFFECT ON METALLURGICAL COKE QUALITY BY STATISTICAL METHODS

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The paper studies coke quality. It was created within project Energy Units for Utilization of non Traditional Energy Sources, reg no. CZ.1.05/2.1.00/03.0069 supported by Research and Development for Innovations Operational Programme financed by Structural Founds of Europe Union.

Blast furnace technique has been interested in iron ore charge; meanwhile coke was not studied because in those previous conditions seemed to be good enough. Nowadays, the requirements for blast furnace coke has risen, especially, requirements for coke reactivity [1]. The level of reactivity parameter is determined primarily by the composition and properties of coal mixtures for coking. The paper deals with a statistical analysis of the tightness and characteristics of the relationship between selected properties of coal mixture and coke reactivity. Software Statgraphic using both simple linear regression and multiple linear regressions was used for the calculations. Obtained regression equations provide a statistically significant prediction of the reactivity of coke, or its strength after reduction of CO_2, and thus their subsequent management by change in composition and properties of coal mixture. [2]

There were determined indexes CSR/CRI for coke. [3] Fifty – four results were acquired in the experimental parts where correlation between index CRI and coal components were studied. For linear regresion the determinant was 55,0204 %, between parameters CRI – Inertinit 21,5873 %. For regression between CRI and coal components it was 31,03 %. For multiply linear regression between CRI and 3 feedstock components determinant was 34,0691 %.

Final correlation has shown the decrease in final coke reactivity for higher ash, higher content of volatile combustible in coal increases the total coke reactivity and higher amount of inertinit in coal increases the reactivity. Generally, coke quality is significantly affected by coal processing, carbonization and maceral content of coal mixture.

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PRODUCTION OF Si_3N_4 ADDED CaO

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Silicon nitride (Si_3N_4) ceramics have a range variety of structural applications such as engine components, heat exchangers, pump seal materials, ball bearings, cutting tools and so on, owing to the excellent mechanical properties at both room and elevated temperatures [1]. The most prevalent methods of silicon nitride preparation are the carbothermal reduction and nitridation (CRN) of silica, direct nitridation of silicon, and thermal decomposition of silicon diimide. The carbothermal reduction takes place according to the following overall reaction [2]:

$$3SiO_2 + 6C + 2N_2 \rightarrow Si_3N_4 + 6CO \quad \text{(Eq.1)}$$

One of the difficulties found in the fabrication process is the sintering applied to attain high relative densities. Therefore, the use of additives to form a liquid phase is required [3]. Sintering aids such as MgO, Y_2O_3 and Al_2O_3 added in α-Si_3N_4 powders, must be homogeneously distributed and possess the desired powder composition before shaping and sintering [4].

In this study, α-phase rich Si_3N_4 powders were synthesized containing sintering additive (CaO) by carbothermal reduction and nitridation. The starting agent for silicon source was high-purity (99 %) synthetic silica. Carbon was added to the high-purity SiO_2 above the stoichiometric amount of oxygen. $CaCO_3$ (for the silicon nitride containing 5, 8 and 10 wt. % CaO) was premixed in the starting reactants depending on the final powder composition and the type and amount of the secondary phases desired for sintering. The synthesis was carried out in a tube furnace at different temperature (1400 °C, 1450 °C and 1475 °C-3h) ranges under nitrogen gas atmosphere. Having completed synthesis process, powder properties were examined by using standard characterization techniques (XRD, SEM, etc).

In this way, additives used in sintering were dispersed more homogeneously in the Si_3N_4 structure and the starting material was produced ready to shape. Having a sinterable Si_3N_4 starting powder lowers production costs. Consequently, lowering production costs is the impetus behind the current study.

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A NUMERICAL ANALYSIS OF THE PRIMARY CRYSTALLIZATION OF PURE ALUMINIUM

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The model was originally designed to confirm and enhance the capabilities of experimental research in the crystallization of pure aluminium (99.99 % Al), specifically to determine the zone of the occurrence of column and equi-axial crystals and the positions of the interface. The character of primary crystallization was investigated on a simple cylindrical sample, crystallizing in a cast-iron mold pre-heated to various temperatures. The experimental research comprised the measurement of temperatures using thermocouples, the evaluation of the experimentally acquired temperature gradients G, and the shift rate of the phase interface R. Furthermore, it comprised the determination of the so-called critical values G_c and R_c, which are reached by the crystallizing metal in the interface where the column crystals transform into the equi-axial. The position of the interface, between the two crystallizations, was established experimentally from the macro-structure along the longitudinal section of the investigated sample. The character of the primary crystallization can be determined after comparing the experimental values of G and R in various places of the sample with the experimental values of G_c and R_c. The numerical model had been developed to expand the limited experimental capabilities of the evaluation of G and R to every point of the longitudinal section, based on the investigation of the 3D transient temperature field within the system comprising the casting, the mold and surroundings. This enabled the prediction of the character of the crystallization in greater detail. The comparison of the numerical and experimental values of G and R has been very successful. Furthermore, the authors have discovered a new criterion (called the 'temperature-delay' criterion), which predicts the macro-structure. This criterion can not only determine the position of the interface between both crystallizations, but also the time in which one transforms into the other.

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EFFECTS OF Si CONTENT ON THERMAL CONDUCTIVITY AND CASTABILITY OF Al-Fe-Si-Zn ALLOYS

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As the amount of heat bound to be removed from electric and electronic devices including LED lighting increases with the larger integration densities of electronic devices and the higher output tendencies, thermal managing technologies have lately become a subject of special interest. Heat sinks made of Al-Si base aluminum alloys such as 383 aluminum alloy by high pressure diecasting process have been regarded as the most common routine, since components with a complex shape favorable to thermal dissipation can be fabricated in net shape with high productivity and without cost penalty. But a low thermal conductivity around 100 W/mK and a poor anodizing characteristics of 383 alloy caused by its high Si content of 10–12 % is becoming a serious problem. Such a high alloying level deteriorates thermal conductivity and moreover non conducting silicon particles, which form as eutectic phase during casting process, severely hamper anodizing characteristics. The enough thick oxidation coating layer should be formed on the surface of heat sinks to obtain a high withstanding voltage, to prevent electric coupling and stray capacitance between heat sink and electronic devices, and to get a decorative appearance.

Therefore, it was aimed to develop a novel low Si containing anodizable aluminum alloy simultaneously possessing good thermal conductivity and castability. For the achievement of this goal, among elements possessing relatively low ratio of resistivity to composition, the elements such as Fe, Si, and Zn advantageous to improve castability, strengthen matrix, and prevent die sticking were multiply alloyed. The Si content was systematically changed from 0.5 to 1.5 %, keeping total alloying levels between 2.5–3.5 %. Thermal conductivity, fluidity, hot tear susceptibility, mechanical strength, and anodic oxidation characteristics of the developed Al-Fe-Si-Zn alloys were compared to those of 383 alloy.

IMPACT OF CASTING SPEED ON TEMPERATURE FIELD OF CONTINUOUSLY CAST STEEL BILLETS

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In continuous casting the casting speed is one of the most important parameters that influence the entire process of steel production. From the physical point of view, the casting speed affects the temperature field formation along the cast steel blank, e.g. the surface and corner temperatures, as well as the solidification of steel, e.g. the shell thickness, isosolidus and isoliquidus curves, the metallurgical length and the width of mushy zone[1]. Moreover, the casting speed is also considerably related to the productivity of steel. In order to achieve a desired steel structure, temperature ranges in particular positions (e.g. due to the straightening), and to minimize the occurrence of surface defects or even cracks it is very important to pay attention to a proper determination of casting speed according to a particular steel grade being cast.

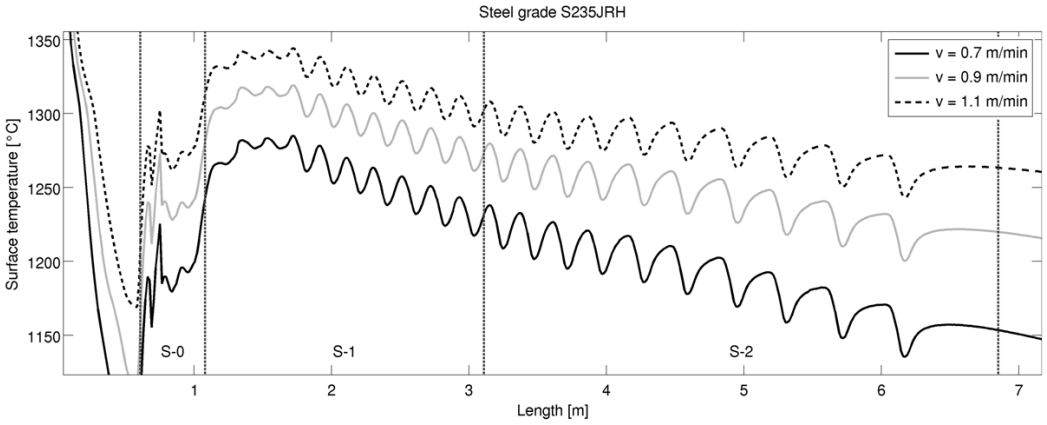

Figure 1: Impact of casting speed on surface temperatures beneath cooling nozzles for steel grade S235JRH

The aim of the paper is to investigate the impact of casting speed and its change on the temperature field formation of continuously cast steel billets, and on aforementioned parameters, mainly on surface and corner temperatures and the solidification through the cast billet. For the analysis the originally implemented numerical model of transient temperature field[2] of continuously cast billets, which has been experimentally verified on a real caster in Zeleziarne Podbrezova in Slovakia, is utilized and several commonly cast steel grades are considered.
The results prove a significant influence of casting speed on the temperature field of cast billets and on related parameters. Conclusions may be utilized, e.g., for the setup of the caster.

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EFFECT OF MODIFIED SILICA/EPOXY NANOCOMPOSITE COATINGS ON THE STEEL SUBSTRATE CORROSION PROTECTION

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Modification of metallic surfaces by various coatings, organic or polymeric, has become an important factor in enhancing the surface properties, such as scratch resistance and corrosion. Corrosion protection coatings on metallic substrates provide an effective physical barrier between the metal and the environment, containing aggressive species. Incorporation of inorganic additives into the organic matrices further improves anticorrosion properties of metallic substrates.

We focus on the preparation of modified silica-epoxy nanocomposites by refluxing epoxy molecule with fumed silica using imidazole as catalyst. The modified fumed silica was then used as filler in epoxy resin. The surface morphology and surface roughness of silica/PVC-coatings were analyzed with scanning electron microscopy (SEM) and atomic force microscopy (AFM). The effect of incorporating silica particles on the corrosion resistance of silica/epoxy-coated steel was investigated by electrochemical techniques in 3.5 % NaCl.

FRACTURE ANALYSIS OF NiTi DENTAL ALLOYS

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NiTi alloys as important technological material finds its wide application in different fields. Due to shape memory and superelastic properties it is widely used in biomedical applications. Generally, nickel titanium alloys are known for their good corrosion resistance, but in some circumstances they suffer from different forms of corrosion, like pitting and crevice. Beside corrosion, the wear resistance of this alloy is of critical concern in many applications. Since dental NiTi archwires experience severe failures in applications, it is of great importance to study and define the cause for the failures.
First, the microstructural properties of NiTi dental wire was investigated. The dental archwires after service operation were removed from patient's mouth. The dental archwires that underwent fracture during operation were thoroughly investigated by the use of scanning electron microscope. Also, optical microscopy, confocal microscopy and X-ray tomography were used to detect surface changes. EDS and Raman as surface characterization techniques served for identifying corrosion products and plaque on the surface of dental wires.
The influence of microstructure, surface preparation and materials characteristics will be presented. Also, the main cause for the fractures will be revealed.

PLASMA ELECTROLYTIC SATURATION OF 316L STAINLESS STEEL IN AN UREA AND AMMONIUM NITRATE CONTAINING AQUEOUS ELECTROLYTE

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Plasma electrolytic saturation (PES) is an environmental friendly-electrochemical process which allows altering the surface chemistry and grain size of the metallic substrates that negatively biased in aqueous electrolyte containing ionic species such as N, O, C and B. Wear and corrosion resistive nano crystalline layers consisting of carbides, nitro carbides, borides and nitro-carbo-oxides can be fabricated by PES in short treatment durations. In this study, PES was performed on 316L steel in an urea and ammonium nitrate containing electrolyte at several treatment durations from 5 sec. to 30 min. Surface morphology, topography and microstructure were investigated by X-ray diffraction analysis, optical and scanning electron microscopy, energy dispersive spectroscopy, micro surface profilometer and micro hardness testing. The wear and friction properties were evaluated using a ball-on-plate linear reciprocating wear testing at 1 to 3 N applied loads with an alumina ball against both treated and untreated substrate. It was found that the PES could increase wear resistance, mechanical properties of 316L stainless steel.

THE EDDITION OF STRONTİUM ELEMENT IN Mg-%3Sn ALLOY AND INVESTIGATION OF ITS PROPERTIES

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In this study, the effect of Sr element in Mg-3 wt.% Sn alloy was investigated. 0.05-0.1-0.2-0.5 and 1 wt.% value of Sr were added to Mg-3 wt.% Sn alloy. The alloys were produced in controlled atmosphere by a gravity-casting process. The microstructures and mechanical properties of the alloys were investigated. The results show that the addition of Sr modified the microstructure. X-ray difractometry revealed that the main phases are α-Mg, Mg_2Sn in the all of alloys. Furthermore, it is not observed Sr based intermetallics in any tested alloys. The hardness of Mg-3 wt.% Sn alloy increased with increasing Sr content. The greatest yield strength, tensile strength and elongation were exhibited by Mg-3%Sn-0.1%Sr alloy.

CHARACTERIZATION OF TiO_2 NANOPARTICLES WITH HIGH-RESOLUTION FEGSEM SCANNING ELECTRON MICROSCOPY

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Scanning electron microscopy is one of the analytical methods that can also be used for the characterization of nanoparticles. Scanning electron microscopes with a field-emission gun cathode (FEGSEM) have a very small electron-probe diameter, which makes it possible to observe the specimens with an ultimate resolution of about 1 nm [1]. For the characterization of anatase TiO_2 nanoparticles we have prepared specimens in three different ways. The TiO_2 nanoparticles were dispersed on polished Al-stubs. The first specimen was uncoated, the second specimen was coated with carbon and the third specimen was coated with a 3-nm layer of Au-Pd alloy. The specimens were observed using two FEGSEM microscopes: a JEOL JSM 7600F and a Zeiss Sigma VP. The SEM accelerating voltage was set to 5 kV and an "InLens" secondary-electron detector was used for the imaging. All the images were recorded without noise-reduction tools. In addition the SEM scanning-transmission (STEM) mode was used at 30 kV with the samples that were prepared by direct dispersion of the nanoparticles on a thin carbon-membrane.

By comparing the images of differently prepared samples we found out that sputtered conductive layers of either carbon or Au-Pd do not improve the results of the SEM analysis. The anatase 5–10-nm-sized nanoparticles were, however, clearly visible on the uncoated specimen. On the carbon-coated specimen the layer of carbon covered the nanoparticles and filled the gaps between them, making an impression of a smoothed, agglomerate surface. The nanoparticles in the specimen coated with Au-Pd could be observed easily with better contrast; however, they appear bigger than in reality. Using the STEM mode we were able to see agglomerated anatase nanoparticles relatively easily, as compared to the demanding SEM high-magnification observation.

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EFFECT OF HEAT TREATMENT ON WEAR RESISTANCE OF THE TiC-Fe COATINGS FABRICATED BY HVOF PROCESSING

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The effect of post-spray heat treatment on the microhardness and wear properties of the thermally sprayed TiC-Fe wear-resistant coating has been investigated. Thermally sprayed coatings were fabricated by HVOF process and the subsequent heat-treatments were carried out at temperatures ranging from 800 °C to 1000 °C in vacuum environment for 30 minutes. The wear resistance of the as-sprayed TiC-Fe alloy coatings was found to be better than that of Cr_3C_2-NiCr alloy coating and similar to that of WC-Co coating. In addition, the wear resistance and microhardness of the coatings were improved by the following heat-treatment in vacuum (~10^{-3}torr). The maximum improvement in microhardness and wear resistance was about 30 and 20%, respectively by the heat-treatment performed at 900 °C in vacuum. It has been revealed, from TEM and Mossbauer studies, that the improved wear resistance in the heat treated coating was mainly caused by the hardness increase associated with martensitic transformation and precipitation of Fe carbides.

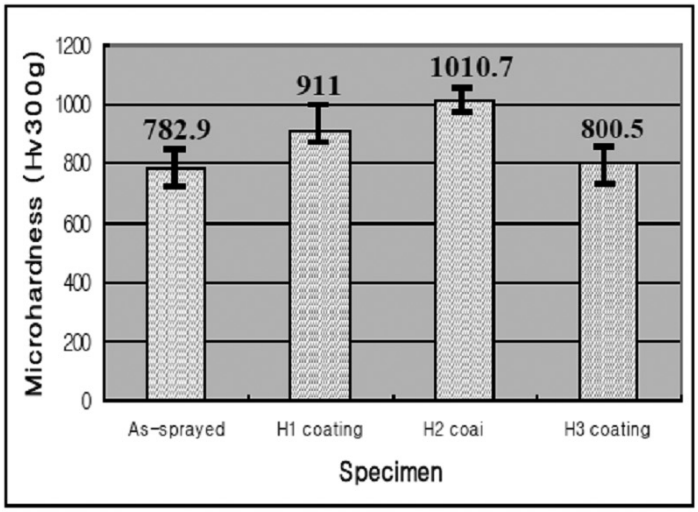

Fig. Hardness test results for the TiC-Fe alloy coatings as-sprayed and heat-treated in vacuum.

Fig. Plain-view TEM images of the TiC-Fe alloy coatings after heat-treatment

INFLUENTIAL FACTORS IN THE SURFACE HARDNESS TESTING OF A NITRIDED LAYER

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Nitrocarburizing is one of the frequently applied processes that significantly improve service life of steel parts in the complex activity of mechanical loads, wear and corrosion damages [1,2]. Characterisation and confirmation of quality of nitrided /nitrocarburised layer is norm prescribed and includes the determination of: surface hardness, nitriding hardening depth, compound zone thickness and its porosity [3,4]. In the testing of surface hardness, in spite of determined conditions, there are additional factors that can affect the obtained result and can lead to a misunderstanding between the customer and the provider of the service of nitriding. In this paper, possible influential factors on the surface hardness are considered and statistically analyzed by the ANOVA two factor test. The considered infulential factors are: surface preparation method and loading force. Tests carried out during the research indicated a significant influence of the loading force and of the surface preparation on the results of nitrided/nitrocarburised steel surface hardness. Also, the indentation size effect is confirmed in the hardness tests with small loading force.

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CASTABILITY AND MECHANICAL PROPERTIES OF Al-Zn ALLOYS FABRICATED BY DIE-CASTING

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Since Al-Si alloys have some microstructural problems induced by the formation of flake-type brittle Si phase during solidification, modification treatment causing fine and fibrous eutectic Si structure is essentially included in casting process. Recently, it has been reported that Al-40Zn-3Cu alloys fabricated by gravity casting showed good wear resistance and superior mechanical properties such as tensile strength of 370 MPa and elongation of 5 %, and suggested the possibility of Al-40Zn-3Cu alloys as a wear resistant materials. Also, the solidification ranges Al-Zn alloys are highly wide enough to achieve well defined casting properties in Al-Zn phase diagram. The previous reports and the binary phase diagram of Al-Zn alloys imply that it is possible to apply Al-Zn alloys to die-casting process for high strength casting products. In the present study, we have attempted to apply Al-base alloys containing more than 20 % Zn to die-casting process. The Al-20~45 wt.% Zn alloys were produced by a high-pressure mold. The produced alloys showed a fine angular type α-Al grain surrounded by very fine (~150 nm) lamellar structure of α-Al and η-Zn. Also, the fine mixture structure of η-Zn and θ phase formed in grain boundary and built a close network around grains. This fine and complex microstructure induced the excellent mechanical properties such as maximum tensile strength of 475 MPa and elongation of 3.5 %. to die-casting process.

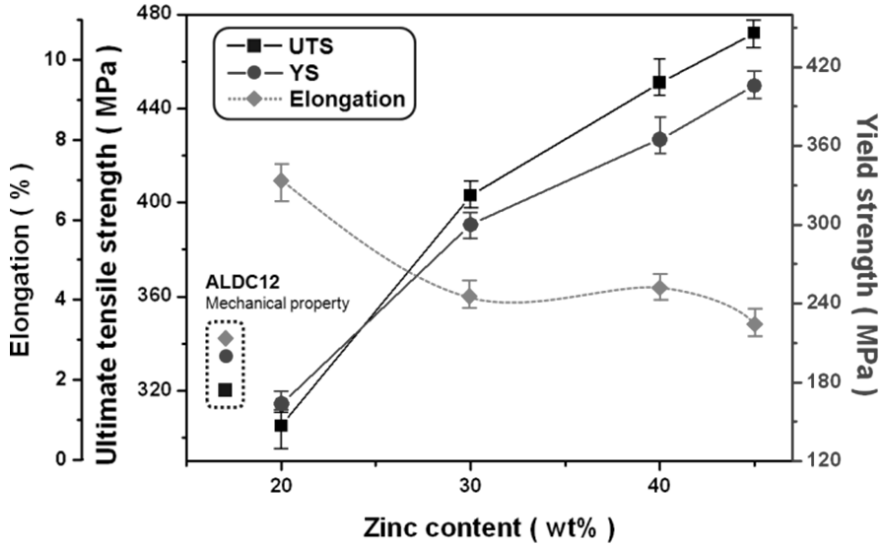

Fig. 1. Tensile properties of Al-xZn3Cu0.4Si0.3Fe alloys (x=20~45 wt%)

NUMERICAL SIMULATION OF PIN SENSOR IN APPLICATION FOR ROLLING FORCES MEASURING

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An understanding of the stress distribution at the interface during a metal forming operation is necessary in order to optimize the technological processes. Friction force significantly affects the flow of the material in the forming tools and is one of the main process factors. Over the years many techniques have been developed for the measurement of normal and friction forces on the interface. One of the widely used techniques is using pin to measure stresses [1]. The measuring element (pin) is in direct contact with the forming material. However, the pin's presence inside tools influences the rigidity of the tool and the flow of the forming material. The measured value of stresses may not correspond when the pin isn't installed. In study [2] they used experimental technique to determine errors in measurements.

This paper presents a numerical simulation of various geometrical configurations. The influence of pin clearance inside the hole and lap of the pin above the surrounding surface is investigated. The analysis focuses on the rolling process and methodology which uses one pin and a three axes force measuring device. The simulation was done using the finite element model of rolling with detail implementation of pin sensor.

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EVALUATION OF MAGNESIUM AND CALCIUM OXIDE STATE IN AUGER ELECTRON SPECTROSCOPY DEPTH PROFILINGS

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It is frequently of interest, especially in applied research, to be able not only to perform concentration profile studies of thin layers but also to determine oxide states of individual constituent elements. Auger Electron Spectroscopy (AES) and especially X-ray Photoelectron Spectroscopy (XPS) are usually used for this, as in XPS influence of chemical state on energy shifts is well researched with databases of shifts in peak positions for different compounds readily available. Sometimes AES is preferred since it can provide highly localised measurement with measurement areas down to tens of nm, collateral benefit being shorter total sputtering time. Problem is that chemical state information is less readily available than in XPS since in AES influence of chemical state on energy shifts is less pronounced than in XPS. There are, however, several cases of large shifts of up to several eV between elemental (metallic) state and different compounds. So, kinetic energy of 1185.5 eV corresponds to Mg KLL in elemental Mg, but ~1180 eV to oxidized Mg. For Ca LMM these values are 298.2 eV for elemental and 292.5 eV for oxidized Ca.

It was also attempted to use additional features, beyond peak position, observed in the AES spectra, i.e. to use Linear Least Squares Fitting (LLSF) procedure to fit Mg KLL and Ca LMM peak shapes with linear combinations of standard elemental and standard oxide peaks thus correlating Mg KLL and Ca LMM peak shapes to the chemical state of the corresponding element. A similar approach had been already tried with some success with Fe MNN and Cr MNN from oxide layer on stainless steel and recently with Al KLL and Zn LMM from 2 different commercial Al-Zn alloy thin layers. Chemical state information derived from AES via LLSF was compared to the one derived from kinetic energy shifts.

ELECTROCHEMICAL STUDIES ON POLYPYRROLE COATINGS USING AS A PRIMER FOR AIRCRAFTS STRUCTURES

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The studies performed in prestigious laboratories [1-3] showed that the polypyrrole coatings can be used as primers in organic systems to replace the chromium traditional primers. Concerning the corrosion behavior of ferritic stainless steels in different aggressive media, can be improved by coatings deposition. The main task of our paper consists in growing of anticorrosion properties of polypyrrole by doping with nickel cobalt oxide.

Electrochemical deposition of polypyrrole on different Aluminum alloys surface were carried out at constant potential from 0.1M pyrrole in 0.2M oxalic acid solution and 0.1M pyrrole in 0.2M oxalic acid. The electrochemical and corrosion behavior of the coatings in different pH solution were studied.

The electrochemical experiments were carried out in a standard one compartment cell with a three electrodes system, using a Gamry galvanostate/potentiostate 5.2 version.

The electrochemical and structural properties were investigated using different methods as: Cyclic voltammetry, OCP measurement, transmission and Scanning Electron Microscopy.

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THERMAL DE-FUNCTIONALIZATION OF OXYGEN PLASMA TREATED POLYETHERSULPHONE

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The phenomenon of spontaneous decay of oxygen rich functional groups on the surface of the polymer was studied by high-resolution XPS. Samples of smooth PES foils were exposed to highly non-equilibrium oxygen plasma created in an electrodeless RF discharge. After receiving the dose of about 1×10^{24} oxygen atoms per m^2 the surface of the polymer became saturated with oxygen rich functional groups such as C–O, C=O, COO–. XPS survey spectra showed an increase of oxygen concentration from original 21 to more than 42 at.%, while high resolution C1s spectra showed that carboxyl group prevailed. The samples were heated in the XPS chamber for different periods and characterized in-situ right after the heat treatment. It is shown that the functional groups decay spontaneously with time and their concentration became below the detection limit after annealing at 200 °C for 8 min.

FATIGUE BEHAVIOR OF ALUMINIUM FOAM

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Aim of the work was to estimate the ultimate force which allows aluminium foam to withstand compression-compression cyclic loading for more than 10^5 cycles. The samples were subjected to cyclic loading by various forces in one given direction and in dependence on foam porosity. Overall deformation below 1mm during the cyclic loading was defined as maximal allowed deformation which determines fatigue of the foam. The ultimate force was defined from uniaxial compression test as the average force responsible for plastic collapse of first pore band within the foamed samples for certain porosity. It was revealed that less than 50 % of the ultimate force is needed to satisfy given endurance limit 10^5 cycles.

INTERFACES AND INTERACTIONS OF ALUMINIUM MMC WITH AN ALUMINIUM ALLOY MELT

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Aim of the work was to study the interactions on the interfaces between powdered aluminium MMC with melt during high pressure die casting. It was focused to reveal the changes on the interfaces in dependence on the MMC composition; casting parameters as pressure, time and temperature were constant. The MMC were prepared from AA 2024, AA 5083, AA 6061 and AA 7075 powders and aluminium of composition AlSi9Cu3 were used for casting. The interactions were studied by using the SEM and EDS (point analysis, line scans and mapping). It was shown no significant changes or interconnection between the MMC and aluminium melt, but local bonding were reveled in case of AA 7075. For further research, the higher temperature, longer casting times, higher pressures or lower density on the surface of the MMC for better admixing should be desirable.

INFLUENCE OF THERMOMECHANICAL PROCESSING ON COLD DEFORMABILITY OF LOW CARBON STEEL WITH NITROGEN CONTENT > 70ppm WHICH IS DEOXIDIZE WITH ALUMINIUM

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The group of steel intended to production of bolts and nuts from the production programe of the Steel Plant "Zenica" Zenica, nowadays Arcelor Mittal Zenica, includes, among others, steel C10C according to EN 10263-2.

In this paper the results of testing mentioned steel, with nitrogen content from 88 to 119 ppm, obtained by specially defined technological program are presented.

The testing on rolled bar with diameter 12 mm, among mechanical and metallographic tests, is focused especially on technological compression test in cold state, which is normally performed as a supporting control in production. The cold compression of test samples has been performed with four degrees of deformation and two different speeds of compression tools. It was determined the dependence between resistance to deformation of material and degree and speed of deformation.

Also, the surface state classification of tested samples is performed with visually control, which was intended to determination deformability of bars produced on this way.

CHARACTERIZATION OF SELECTED PHASE CHANGE MATERIALS FOR PROPOSED USE IN BUILDING APPLICATIONS

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Thermal energy can be stored as a change in internal energy of a material as sensible heat, latent heat, thermo-chemical energy or combination of these (Sharma *et al.*, 2009). Phase change materials (PCMs) are substances with high latent heat that can be used for thermal storage. The potential use of encapsulated PCMs integrated in building structures is in the increased of thermal storage capacity of building envelope.

The thermal storage capacity of a PCM depends on the specific heats in each state and the latent heat of each phase transformation (Günther *et al.*, 2009). Large heat of fusion and suitable transition temperature are two main constraints for suitability of PCMs for a specific application. Differential Scanning Calorimetry (DSC) is a standard method for thermal analysis (Castellón *et al.*, 2008). DSC Perkin Elmer PYRIS1, equipped with a cooling device (Perkin Elmer Intracooler 2P), was used for determination of the thermal properties (thermal capacity, heat of fusion and melting range) of selected organic and inorganic PCMs with proposed use in building structures. Selected commercial and non-commercial PCMs were tested. All experiments were carried out at rates 20; 10; 1; 0.5 and 0.1 °C min^{-1} to investigate the influence heating and cooling rate on thermal properties. Thermogravimetric apparatus (TGA) Q500 TA Instruments was used for evaluation of thermal stability of the PCMs. Tests from TGA showed a good thermal stability of PCMs within a proposed use in building structures.

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PRODUCING ANTI-BACTERIAL SILVER DOPED HYDROXYAPATITE POWDERS WITH CHEMICAL PRECIPITATION AND RESHAPING AT SPRAY DRYER

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Hydroxyapatite is used for fixation of orthopedic prostheses and it has reached a significant level of clinical application [1]. HA is not only bioactive but also osteoconductive, non-toxic, non-immunogenic [2]. In this study, the aim was producing anti-bacterial silver doped hydroxapatite powders and reshaping at spray dryer. The hydroxyapatite is produced by the chemical precipitation method. This process is simple, low cost and suitable for industrial production but resultant particles have low quality with a large particle size, wide particle size distribution and a lot of agglomerates [2]. Silver has been known to exhibit strong cytotoxicity towards a broad range of micro-organisms [3]. For producing hydroxyapatite 1, 2, 4 wt. % silver was added to hydroxyapatite structure. E. Coli bacteria was used to investigate powder's anti-bacterial specimens. Different temperatures and pressures were used at Spray Dryer. Scanning Electron Microscopy (SEM), X-Ray Diffraction (XRD), (EDX), and bacterial tests were used to characterize specimen powders.

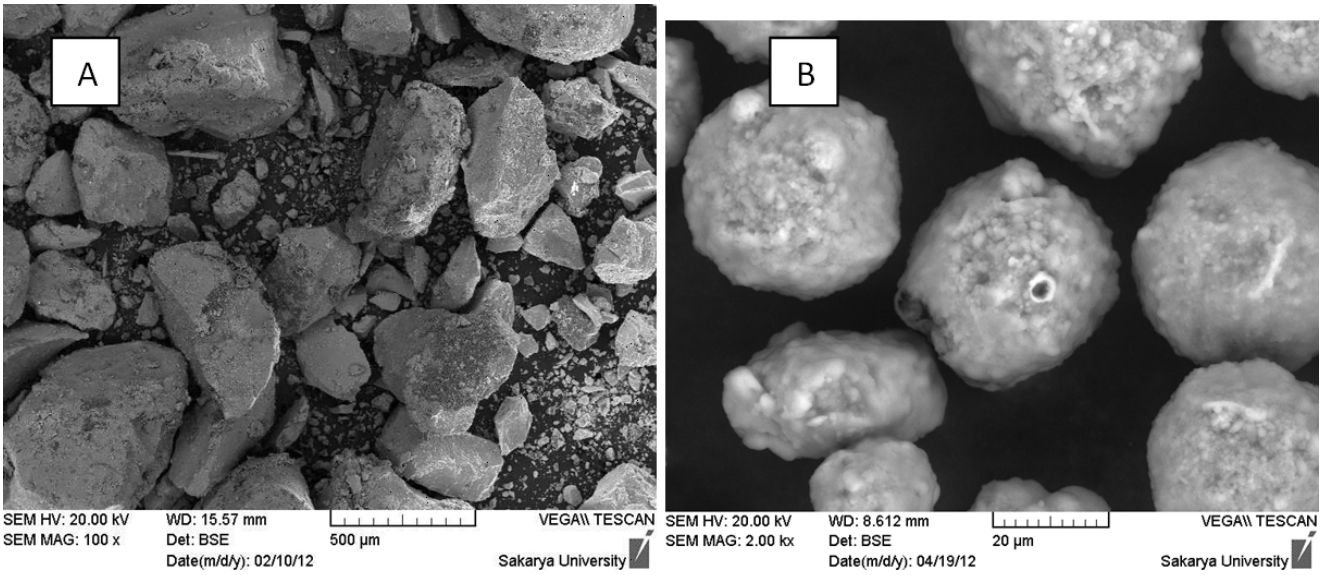

Figure 1. Hydroxyapatite powder. A) Before Spray Dryer, B) After Spray Dryer 2000x

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INVESTIGATION OF FATIGUE PROPERTIES OF TRAIN BRAKE PADS MANUFACTURED FROM CAST IRON AND CARBON-CARBON COMPOSITES

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Carbon-carbon composites are structural materials consisting of carbon matrix reinforced with carbon fibers and they are extensively used as train brake pad materials on account of their excellent tribological behaviour at high sliding speeds [1]. They have several good properties such as excellent thermal and structural stability, high heat of ablation, high specific stiffness and strength, light weight, and long service life, which make them attractive to use in brake discs [2]. As a result of repeated rolling contact of brake pads and wheel, fatigue failure is observed in brake pads [3,4].
The gray cast iron has been used as brake materials in railway vehicles before carbon-carbon composite pads were manufactured. A certain number of railway disc brakes, made of gray cast iron, shown the presence of cracks only after a few thousand kilometers. Because, disc brakes, not only for railway applications but generally, count as safety components. Therefore, their reliability during service is essential [5]. Disc brakes are exposed to large thermal stresses during braking. In addition to substantial mechanical forces, friction heat generation is extremely high. The heat generated during braking causes temperature increase at the interface, which spreads fast through the brake components. Such severe thermal processes modify friction and fatigue strength of the materials in contact, cause wear and, on a large scale, result in component deflection. All these changes inevitably affect brake performance and life [5].
In this study, fatigue behaviours of two types of brake pads as cast iron and carbon-carbon composites used in railway transportation were investigated. Both cast iron and carbon-carbon composite brake pad specimens were exposed to fatigue tests in different stress amplitudes as 300, 400 and 500 MPa to determine the service performances. S-N curves of both specimens were drawn and microstructures of them were investigated by SEM.

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MICROSTRUCTURE CHARACTERIZATION OF ALUMINUM ALLOYS AA 6062A-T6

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Aluminium alloys AA 6062A-T6 (AlMgSiBiSn) is widely used as free machining aluminium alloys due to the environmental issue. In AA 6062A-T6 alloys Pb is substituted by Bi and Sn. The present paper presents the microstructural characteristics of an extruded AA6012A-T6 (AlMgSiBiSn) alloy and the microstructural changes occurring during different manufacturing operations and changing the parameters. The machinability of the AA6062A-T6 alloy is the most important property of those alloys. Theory indicates that the extensive plastic deformation induces a preferred orientation of the grain structure and secondary phases along the shear plane, and a local increase in the alloy temperature. Low melting point compounds, such as the Sn and Bi bearing particles, transform into a soft or liquid state, changing their initial compact shape to assume needle–like morphology. The β-Mg_2Si and α-Al(FeMn)Si particles are not influenced by the working temperature and keep their initial shape. However, the low melting point compounds enable the material during the machining to break in small chips.

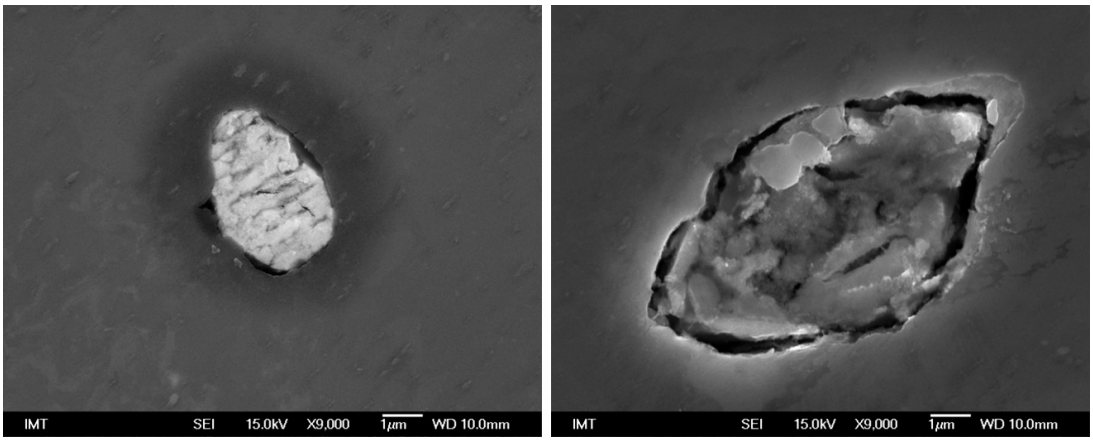

Figure 1: SE image of the inclusions in free machining aluminium AA 6062A-T6 alloys; a) inclusion based on Bi, b) inclusion based on Sn.

FULL AND FLUX-CORED ACTIVATED WIRE APPLICATION FOR ARC WELDING OF LOW CARBON STEEL IN CO_2 AND CO_2 GAS MIXTURES

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In this work are given the results of mechanical testings and welded joints microstructure testings obtained from welding with flux cored (activated) and full (classical) electrode in a protective atmosphere of gas mixtures and CO_2 protection. According to the obtained results, it could be stated that the welding with a flux cored (aktivated) electrode, in a protective atmosphere of mixture $Ar+CO_2+O_2$, brought to the welded joints quality improvement.

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Acknowledgements
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THE MEMBRANE SURFACE CHARACTERIZATION: ZETA POTENTIAL AND CONTACT ANGLE MEASUREMENTS CORRELATION

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Nanofiltration is relatively new pressure driven membrane separation process for lower molar mass molecules (natural organic matter, ions), and the properties of both the membrane and the solute have a significant effect on the performance of the filtration process. Surface energy, defined as the amount of energy per area required to disrupt the intermolecular bonds of an infinitesimally small unit surface, is an important surface property of material. It can be used to derive the solid-liquid interfacial energy and the free energy of hydration. These are very important parameters and determine the interactional forces between two different media and control the stability of aqueous colloidal suspensions, the dynamics of molecular self-assembly, surface wettability, and adhesivness.[1]

Contact angle measurements (sessile drop technique) were used to determine the surface energy of different commercially available polymeric membranes. The work of adhesion (Gmw) between membrane and water was calculated from application of the Young-Dupre equation. Charge formation on polymer surfaces was determined from zeta potential measurements and the correlation between results, obtained by these two different techniques were discussed. The zeta potential (ZP) is a function of the surface charge which develops when any material is placed in a liquid. Zeta potential measurements were obtained using Adjustable Gap Cell (SurPASS instrument, Anton Paar GmbH, Graz, Austria) where streaming current technique was chosen. Regarding parameters based on geometry of the measuring cell the so called correct zeta potential was evaluated.

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EFFECT OF CRYOGENIC TREATMENTS ON MECHANICAL PROPERTIES OF AISI 420 STAINLESS STEEL

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The objetive of this study was to determinate the effect of cryogenic treatment on hardness and impact toughness on martensitic AISI 420 stainless steel. Research made over the last three decades has indicated that wear resistance of steel alloys can be improved substancially by deep cryogenic treatment. In order to establish its influence on the microstructure before and after its application, optical and high resolution transmission electron microscopy with X-Ray microanalysis were used. While hardness was evaluated with the Vickers technique, impact toughness by mean of Charpy V tests, and the micromechanisms of fracture surfaces were analyzed by scanning electron microscopy images.
All the specimens were heated up to 1030 °C in an argon atmosphere and oil quenched. Liquid nitrogen was used as cooling medium to achieve cryogenic temperature (–196,4 °C). Two cooling methods were employed, one by direct immersion of specimens in the nitrogen, and the other one, a controlled cooling of 27 °C/min. Soaking time varied between 1 and 2 hours at cryogenic temperature. After that, all samples were tempered at 410 °C during 25 minutes in a furnace cooling.
Microstructural changes, hardness and absorbed energy during impact were studied. From the analysis of the obtained results, it was found that the best properties were achieved with one hour of soaking time with controlled cooling. This treatment developed a hardness increase in the order of 10%, compared to the quenched and tempered condition. Although the absorbed energy decreased in the same order of magnitude, in all cases, SEM analysis of fracture surfaces showed the presence of dimples.

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EVALUATION OF COAL CHARGE EFFECT ON METALLURGICAL COKE QUALITY BY STATISTICAL METHODS

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Blast furnace technique has been interested in iron ore charge, meanwhile coke was not studied because in that previous conditions seemed to be good enough. Nowadays, the requirements for blast furnace coke has risen, especially, requirements for coke reactivity. The level of reactivity parameter is determined primarily by the composition and properties of coal mixtures for coking. The paper deals with a statistical analysis of the tightness and characteristics of the relationship between selected properties of coal mixture and coke reactivity. Software Statgraphic using both simple linear regression and multiple linear regressions was used for the calculations. Obtained regression equations provide a statistically significant prediction of the reactivity of coke, or its strength after reduction of CO_2, and thus their subsequent management by change in composition and properties of coal mixture.

SOL-GEL ANTICORROSION COATINGS FOR ELECTRONIC BOARDS

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Anticorrosion coatings for electronic boards (EBs) should correspond to a unique set of corrosion-related issues, since EBs are composed of various materials (metals, alloys, soldering,…) in close proximity, which brings about great possibility for galvanic corrosion. In addition, the surface of EBs is not flat and it is difficult to cover it homogeneously. Nowadays mostly conformal paint coatings (urethane, acrylic,...) are used for protection of EBs, but such coatings usually do not offer satisfactory adhesion and protection (<10 years) [1]. It is believed that nanocomposite barrier coatings, consisting of nanoparticles (SiO_2, Al_2O_3, ZrO_2,...) or polyhedral oligomeric silsesquioxanes (POSS), embedded either in organic polymers or sol-gel matrices are promising materials to replace the conformal coatings.

Preparation of good sol-gel nanocomposite coatings starts with an appropriate selection of precursors, nanoparticles, inhibitors and additives [2]. In this work as the network former for sol-gel nanocomposite coatings bis end-capped alkoxysilyl-functionalised precursor bis-(3-(3-(3-triethoxysilyl)propyl)thioureido)propyl terminated polydimethylsiloxane (PDMSTU) was chosen. This organic-inorganic hybrid precursor comprises also polydimethylsiloxane chain imparting the hydrophobic character to the deposited coatings. Nanoparticles were included as trisilanol-heptaisooctyl-POSS, which due to the open-cage structure can bind in the sol-gel matrix. Potentiodynamic polarization (PD) measurements of coatings deposited on aluminium alloy AA 2024 showed that cathodic current decreased for about 3-4 orders of magnitude. SEM micrographs revealed a homogeneous surface, but after PD homogeneous areas, sites with small and large defects developed. Ex-situ approach for the investigation of corrosion processes was performed using Raman imaging. It was encouraging to note that Raman images can be obtained also on an electronic board spray coated with PDMSTU-based sols. The measurements revealed the coverage of all pins on EBs with the coating.

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HRTEM AND HAADF-STEM STUDY OF {110} TWINS IN PYRITE

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We present an atomic-scale study of the structure and chemistry of twinned pyrite crystals from Mt. Katarina, Slovenia.[1] Twinned crystals were cut parallel to the (001) plane, with a twin nucleation point of intersecting (1–10) and (110) planes, placed near the centre of the TEM specimen. Near the centre, the boundaries between the two interpenetrating twin domains follow {110} planes and make occasional steps to {100} planes. In regions far from the nucleation point {100} boundaries start to dominate over the {110} boundaries. According to our observations (see the illustration) the primary {110} twin boundary (type-A) deflects into secondary {100} interfaces (type-B), following a simple crystallographic relationship: (110) → a·(100) + b·(010), where the fractions of both components are a=b for an idealized interpenetration twin, and a≠b in the case of realistic twins. EDS chemical analysis[2] of type-A and type-B interfaces showed that the primary twin boundaries comprise a significant amount of Cu, whereas the secondary twin boundaries are devoid of any dopants.

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STUDY OF INTERFACIAL TENSION AT THE INTERFACE MOLTEN OXIDE SYSTEM/MOLTEN STEEL

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The presented paper is focused on the study of interfacial tension between selected oxidic and metal phase. Interfacial phenomena plays essential role in many metallurgical processes, in which there co-exist two immiscible liquid phases. Experimental study of these phenomena is very difficult and this is the reason why there are not commonly accessible literary data to predict the interfacial effects at the interface oxidic phase/metal. In this work the influence of carbon content in steel on interfacial tension was studied. For this purpose the steel with 0.411 wt. % of carbon and steel with 2.64 wt. % of carbon were chosen. Because of wide variety of oxidic systems used in the industry, characteristic system of casting powder was chosen for this study. This system contains dominant components, which mainly are SiO_2, CaO, Al_2O_3 and MgO, and also a range of attendant mixtures as for example Fe_2O_3, TiO_2 and Na_2O.
Simultaneously the influence of SiO_2 on temperature dependence of interfacial tension was observed. For this reason a concentration series with gradual additions 3; 6; 9 and 15 wt. % of SiO_2 was created. Experimental research of interfacial tension was performed in horizontal resistive graphite Tamman furnace using original method of measuring. This method consists in fixing both liquid phases in horizontal position using the thorn made of tungsten wire in corundum cover.

Acknowledgements
The work was carried out in the scope of the student's projects SP 2012/25 entitled "Experimental study of inorganic heterogeneous systems" and SP 2012/196 entitled "Specific research in metallurgy, materials and process engineering" and it was financed from the specific research resources of the Faculty of Metallurgy and Materials Engineering, VŠB – Technical University of Ostrava, Czech Republic.

EFFECT OF GRAPHITE SHAPE OF SOLID IRON ON INTERFACIAL BONDING CHARACTERISTIC OF ALUMINUM-CAST IRON BIMETALS

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Since vehicle weight reduction and consequential fuel economy improvement are strongly required due to global warming and energy saving problems, the amount of aluminum for vehicle components is gradually increasing. But aluminum has to find a solution for its lower mechanical properties such as strength, fracture resistance and, stiffness to replace ferrous metal components. In this circumstance, local reinforcement of aluminum using ferrous metal alloys can provide automobile industry with the ability to combine the weight reduction and performance improvement of vehicles. A variety of methods for producing aluminum-ferrous metal alloy bimetals are available, the casting technique is found to have lot of potential advantages in view of its simplicity, cost effectiveness, and ease of adaptability in foundries compared to other methods. In casting technique, bimetallic components are fabricated directly into near net shape by casting aluminum alloys into a mold with ferrous solid metal inserts. However, recent studies have shown that a sound metallurgical bonding between the solid metal insert and the aluminum casting is the key point to insure better technical performance and reliability of bimetallic components. In this study, the interfacial bonding characteristic of a wrought aluminum alloy-cast iron bimetal was investigated, since wrought aluminum alloys and cast irons are more favorable to repair and net shape fabrication of aluminum vehicle components respectively than casting aluminum alloys and steels. Especially, the effects of graphite shape of solid iron on wetting and interfacial reaction between the aluminum melt and the solid iron were intensively examined. The bonding strength of aluminum-iron bimetal was evaluated as functions of graphite shape and de-graphitization condition.

CALCULATION OF STATIONARY CREEP RATE FOR TEMPERED MARTENSITE

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In microstructure of tempered martensite, the matrix creep proceeds with dislocation glide (slip) and climb. Theoretically, by increase of stress and temperature, only creep rate is increased. As creep in matrix is constant, it is logical to conclude that creep activation energy is independent of temperature and stress exponent that both affect creep rate, only. By long time creep tests, carbide particles size and spacing grow with rate according to Lifshitz-Slyozov-Wagner equation. The rate depends of several parameters and it is proportional to diffusion rate and solid solution molar content of carbide forming elements in solution in ferrite. The content of these elements in creep resistant steels and their diffusion rate in ferrite differ significantly, the particles coarsening rate differs also strongly.
The aim of this work was to propose a modified equation for calculation of dislocation creep rate of tempered martensite in which particles size and spacing as well as basic characteristics of microstructure are being considered.

RHEOLOGY: IMPORTANT TOOL FOR DETERMINATION OF PROPERTIES OF SOLS FOR ANTICORROSION COATINGS DEPOSITION

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Understanding the rheological properties of materials can certainly help to develop a better product, since the physical properties link material formulation and processing stages with the ultimate end use and product performance. Rheology [1] is used to measure fluid properties like viscosity, as a function of shear rate/shear stress, in order to determine non-Newtonian flow behaviour, or to measure complex rheological properties such as viscoelasticity (G', G") as a function of frequency (time) or temperature. Rheological properties are of great importance also from the aspect of dispersing the nanoparticles in formulations [2]. In this work the rheological properties of sol compositions for the deposition of anticorrosion coatings on the basis of 3-glycidoxypropyltrimethoxysilane (GPTMS) were studied. The important feature of GPTMS is that on one side of the molecule it can react via sol-gel processes, while epoxy ring on the other side of the precursor can be opened by amino moieties [3]. We applied poly(dimethylsiloxane), aminopropyl terminated (NH_2-PDMS-NH_2) for this purpose. In addition, trisilanol-heptaisooctyl POSS (polyhedral oligomeric silsesquioxanes) molecules were added to strengthen and thicken the coatings. An important property of POSS is that they can be used to tune the chemical and physical properties of the coatings through functionalization of their organic shell and the open-cage POSS can bind into the sol-gel matrix. Detailed rheological measurements were made for sols prepared on the basis of all three described precursors, acidic catalyst and alcoholic solvent. During sol-gel processes the changes in rheological properties were followed with time-oscillation tests in the linear viscoelastic range. The results enabled evaluation of the effect of the addition of NH_2-PDMS-NH_2 to GPTMS on time of gelation and viscoelastic properties of formed gels.

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IDENTIFICATION OF MATERIAL PARAMETERS OF SUBSTITUENTS OF UNIDIRECTIONAL FIBER COMPOSITE USING MICRO-MODEL

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In this work a micromodel of unidirectional fiber reinforced composite is modified to match the real material behavior. First, tensile tests with specimens in different fiber directions are performed on test machine. The resulting force-displacement dependencies are used as target functions for the tensile tests obtained numerically on a unit cell. Unit cell, the representative volume element of composite consisting of carbon fiber and epoxy matrix is first modeled in *Siemens NX* and then modified and solved in finite element code *Abaqus*. Fibers are considered as transversely isotropic material with stiffening effect in axial direction and epoxy as elasto-plastic isotropic material with damage. The Young's moduli, shape parameters of work hardening function and damage model parameters are adjusted in optimization process using *OptiSLang* software in order to minimize difference from the target functions.

THERMO-KINETIC SIMULATION OF V AND Nb DISTRIBUTION IN HIGH CHROMIUM, CREEP-RESISTANT POWER PLANT STEELS

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Tempered martensite ferritic steels with 9-12% Cr are used for fossil fuel fired power plant components. The microstructure of tempered martensite ferritic steels consists of a high density of internal interfaces, carbides and mobile dislocations in body centred cubic (bcc) ferrite [1]. Carbides increase the creep resistance of tempered martensite ferritic steels because they represent obstacles to dislocation motion. On the other hand, the evolution of alloy carbides during ageing treatment can greatly influence the overall properties of steels, especially creep resistance and yield strength [1].

Since thermodynamic calculations and kinetic simulation have become important approaches in understanding materials' properties and processes, early stages of precipitation, the growth and coarsening of carbides can be predicted using these tools [2,3].

In literature, there is only limited amount of information about V and Nb distribution in solid solution and in precipitates during long-term thermal exposure of creep resistant steels.

Therefore, the thermodynamic calculations will be performed using the Thermo-Calc software, using the TCFE5 database. The thermo-kinetic simulation of V and Nb distribution between carbide particles and solid solution during long-term thermal exposure of the heat-resistant power plant steel X20CrMo121 and P91 will be carried out using DICTRA software in combination with TCFE5 and MOB2 databases.

The aim of this study is to calculate the contents of vanadium and niobium in solid solution of ferrite in the temperature range of stability of VC, NbC, and $M_{23}C_6$ in two grades of high chromium creep-resistant steels and to determine the partitioning of the elements. The assumption here is that the coarsening rate is proportional to the molar content of the carbide forming elements. Moreover, the results of our theoretical calculations will be compared to available experimental data and further discussed.

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ELECTRIC ARC FURNACE PRODUCTIVITY OPTIMIZATION

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Store Steel ltd is one of the biggest spring steel, forging steel and exem steel producers in Europe. Electric Arc Furnace is one of the most important equipment in steel plant. Electric Arc Furnace enables to melt scrap as fast as possible with maximum energy input. Electrical energy input depends on secondary current and secondary voltage of furnace transformer tap which influences on electric arc burning stability. The most influential supply network parameters (secondary current, secondary voltage, resistance, inductive resistance) have been optimized by the genetic algorithm method. Due to optimization results higher productivity (5%), lower energy consumption (3.5 %) and lower productivity costs (8.7%) were achieved during one year period.

INFLUENCE OF CHEMICAL COMPOSITION OF A STEEL ON THE TEMPERATURE FIELD OF CONCAST SLAB

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Original numerical model was applied to the simulation of the transient temperature field of concast steel slab of two different chemical composition. The model solves the Fourier-Kirchhoffs equation of the temperature field of slab- crystallizer system respectively slab-ambient system with these main thermophysical parameters : thermal conductivity, specific heat capacity, density and enthalpy. When both melts follow closely after each other, the critical state of so called break out occurs at a certain point secondary cooling zone of a caster. The break was detected in the unbending point of the slab, at a distance of 14.15 m away from the level of the melt inside the mould, there occurred a breakout between the 7th and 8th cooling segments of the secondary cooling zone. It is probably a combination of surface defects. However different chemical composition of two steels and their mixing is apparently decisive. Therefore the temperature model has simulated the temperature history of every point of a cross-section of a slab during its movement through the whole caster from the level of the melt in the crystallizer to the cutting torch for both melts and and for their mixture. Calculation of the temperature field of a slab has focused mainly on the part of the slab before the break out and its surroundings. Calculation results were compared graphically by means of a graph of temperatures in characteristic points of the cross section, a graph of isotherms in the critical cross-section passing through the break out including isoliquidus and isosolidus, a graph of isotherms in longitudinal sections and a graph of increase in thickness of a solidified shell. The results of the temperature field can establish a model of the chemical heterogeneity of steel supported by material expertise on samples taken from the break out.

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ENVIRONMENTAL EVALUATION OF WELDED VS. BOLTED JOINTS IN STEEL CONSTRUCTIONS

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Traditionally, constructions and products were designed and developed without major consideration about their impact on the environment. Over the past 25 years, issues regarding environment have gained greater public interest and recognition. In the designing process, engineer has several different options to design the joint in constructions regarding fabrication processes. Since welded and bolted joints are two most common options to connect construction elements, we compared the potential environmental effects of these two types of joints by conducting LCA analysis. Life cycle assessment (LCA) is technique to assess environmental aspects associated with a product or process by identifying energy, materials and emissions over its life cycle.

Two different designs of joints were compared, simple and more complicated beam-to-column joint, both made of steel. The joints are fabricated using two different technologies: welding and bolting. Each fastening technology has its advantages and disadvantages for manufacturing, installation, and material usage. Before comparing environmental impacts, detail analysis of joints strength were made. LCA used has a “cradle to gate” perspective and due to its comparative nature, some of the system elements were neglected, since they didn’t influenced final results.

In designing process, after satisfying structural and safety needs designers can also evaluate economic and environmental influence. Results of the research work will be helpful for designers to better understand which fabrication process of joint is optimal from environmental point of view. It can be concluded that energy use and environmental emissions can be reduced through a careful selection of type of fabrication process used for joints in steel constructions.

INFLUENCE OF MICROWAVE RADIATION ON THE STRENGTH CHARACTERISTICS OF CERAMIC BODY

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This paper deals with the experimental verification of the effect of microwave radiation on the strength characteristics of the ceramic body. Nowadays, Microwave radiation is used due to its characteristics for drying the wet construction walls, where its effect is relatively sharp decrease of moisture in the material. Precisely the sort of microwave radiation and water vapor pressures can significantly degrade the properties of the brick body. For this reason it is necessary in rehabilitation to choose different performances of microwave emitters to dehumidification as efficient as possible, while avoiding degradation of mechanical properties of the body brick.
In view of the above mentioned facts have been taken some experimental verification of these properties. The paper will present results of experiments aimed at determining whether microwave drying occurs due to weakening of the body brick, to what extent and under what conditions. Contribution will also focus on identifying the necessary power of microwave emitters, which would be effective for microwave drying of ceramic body without its significant weakness.

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DEVELOPMENT OF CONSOLIDANTS BASED ON THE SOLUBLE CALCIUM COMPOUNDS FOR HARDENING OF HISTORICAL INORGANIC MATERIALS

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The main goal of restoration procedures is to preserve functional, visual and structural integrity of monuments, emphasizing the overall aim of original material perseverance. Consolidation of inorganic materials such as stone, render and brick has long tradition in conservation science. In order to achieve good chemical, physical and aesthetic compatibility between consolidants and historic materials, a range of consolidants of different chemical composition are needed. Very frequently used consolidants based on tetraethoxy silane are effective in consolidation and hardening different porous inorganic materials, but they can have poor affinity to carbonate materials and materials with large pores.

For the consolidation of carbonate materials, $CaCO_3$ forming consolidants are preferable. Diluted suspensions of $Ca(OH)_2$ nanoparticles in different alcohols are usually used for consolidation of limestone and other low-porosity carbonate materials. The disadvantage of nanolime consolidants is low penetration depth and the whitening effect of coloured surfaces.

In the case of carbonate materials, $CaCO_3$ forming consolidants have been developed based on soluble calcium compounds which will enhance their penetration depth. New consolidants show excellent penetration, of few centimetres in depth. High calcium concentration provides very efficient consolidation with no whitening affect on the colour surface of historical substrate.

Research activities have been carried out in the scope of the European project “Protection of cultural heritage objects with multifunctional advanced materials”.

INFLUENCE OF DEEP CRYOGENIC TREATMENT ON MICROSTRUCTURE OF ADI

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Application of deep cryogenic treatment in heat treatment processes of different types of steel showed significant influence on their mechanical and tribological properties. A lot of research on that field has been performed also on other kinds of material such as hard metal, grey cast iron, aluminum and aluminum alloys, etc. In this research influence of deep cryogenic treatment on properties of austempered ductile iron has been investigated. Base material for research was perlitic – ferritic ductile cast iron grade EN-GJS-600 (DIN GGG 60) which was austempered and deep cryogenically treated and afterward tempered on different temperatures. Hardness of specimens was measured by use of Vickers hardness method, and abrasion wear resistance of specimens was tested with standard ASTM "dry sand/rubber wheel" method. Preliminary results showed that deep cryogenic treatment did not affect significantly on hardness of tested samples, but it increases the abrasion wear resistance. Microstructures of all samples were characterized in order to define the microstructural changes during deep cryogenic treatment that influenced on mechanical and tribological properties of ADI. Therefore, metallographic specimens were etched with several etchants (Beraha-Martensite, SMB – sodium metabisulfite, KLEMM I and Picral) and analyzed by use of light microscopy and scanning electron microscopy. The microhardness of different phases in revealed microstructures was also measured. Obtained results show that deep cryogenic treatment in combination with the different tempering temperatures affects the matrix microstructure of ductile cast iron and ADI, which has led to increased resistance to abrasive wear of the surveyed states.

BIO-SCOURING AND BIO-BLEACHING OF COTTON

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A new commercial bio-bleaching process of cotton fibers was investigated in this study. The process runs enzymatically with enzymes arylesterases (EC 3.1.1.2) and hydrogen peroxide. The enzyme system catalyses perhydrolysis of propylene glycol diacetate. During the reaction propylene glycol and peracetic acid in situ are formed. The main advantage of bleaching with peracetic acid is that a satisfactory degree of whiteness can be obtained at 60 °C at neutral pH. There is also no damage to the cotton fibre when peracetic acid is used. The objective of our work was to investigate the bleaching performance of the new bio-bleaching process on a traditionally alkaline scoured and bio-scoured 100 % cotton fabric. Secondly, the feasibility of a one-bath combined bio-scouring and bio-bleaching pre-treatment was investigated. The treatments were performed in a laboratory dyeing apparatus. After the treatments samples of remaining baths were collected. Their ecological parameters, final pH and TOC, were measured. The remaining hydrogen peroxide and peracetic acid concentrations were determined by iodometric titration with sodium thiosulphate. Finally, the whiteness degree, tenacity at maximum load and water absorbency of treated cotton fabrics were compared. The results show, that new bio-bleaching system with enzymatically generated peracetic acid has a powerful bleaching ability at mild process conditions (neutral pH, temperature 65 °C). Further, bio-scouring and bio-bleaching can efficiently be combined in a one-bath process.

MINIMIZATION OF SURFACE DEFECTS BY INCREASING THE SURFACE TEMPERATURE AT THE SLAB CONTINUOUS CASTING STRAIGHTENING

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Surface temperatures of cast slabs at small radius segments in front of as well as at the unbending point belong to parameters that affect the surface quality of continuously cast slabs. Older machines for continuous casting were designed with regard to the performance (to amount of cast slabs) rather than to the quality. Therefore, the adaptation of secondary cooling is required in order to accomplish the desired surface temperatures. The modification consists in the dynamic control of secondary cooling, surface temperatures monitoring by means of the numerical model of temperature field as well as in a prospective replacement of cooling nozzles. In order to optimize and control the secondary cooling, characteristics of nozzles and especially the influences of water flow rate, air pressure, casting speed and surface temperatures to the heat transfer coefficient under nozzles have to be known. Moreover, the heat transfer coefficient can be also influenced by the age of nozzles. The paper deals with relationships of described influences and their impacts to the temperature field of cast slabs. The results are presented for the 1530 × 250 mm slabs that are cast in Evraz Vítkovice Steel where the main author's dynamic 3D solidification model is used to control the production interface and runs in off-line version. Its results can be used as a preparation tool for the real casting process.

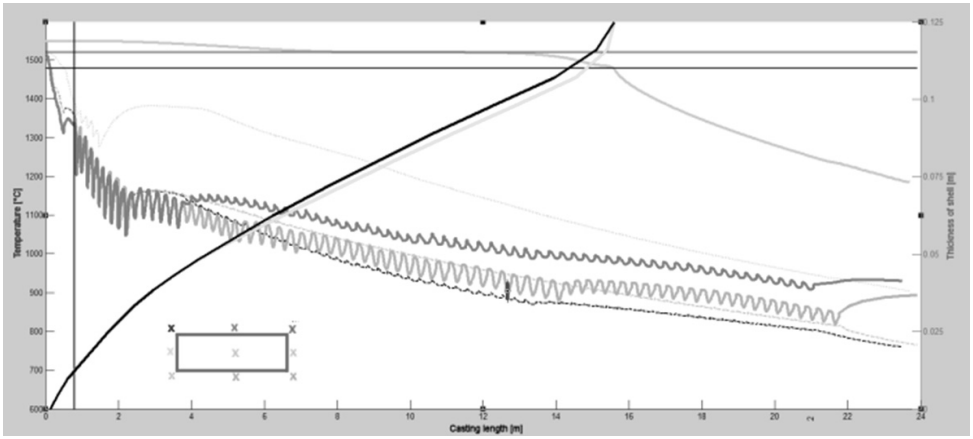

Fig. 1: Temperature along caster for different configuration of secondary cooling in zone 6, 8 and 10.

ELECTROLYTE BASED ON SINGLE END-CAPPED ALKOXYSILYL-FUNCTIONALISED IMIDAZOLIUM-BASED IONIC LIQUID

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Ionic liquids gain importance due to their physico-chemical properties like non-volatility, temperature and electrochemical stability [1] and have been recognized as suitable candidates for electrolytes for various electrochemical cells, for example hybrid electrochromic cells (HEC) [2]. Such cells are composed of optically active WO_3 layer, the counter electrode is a layer of Pt (2 nm) and the I_3^-/I^- redox electrolyte in-between. As a precursor for electrolyte, we investigated an alkoxysilyl-functionalized ionic liquid 1-(2-(2-methoxyethoxy)ethoxy)ethyl)-3-(3-(trimethoxysilyl)propylimidazolium iodide ($(EO)_2$-TMSPIm$^+$I$^-$). After addition of iodine triiodide anions formed. This ionic liquid is sol-gel functionalized, therefore, it can react via sol-gel reactions to form siloxane network. Rheology measurements revealed formation of a very weakly gelled structure that can significantly diminish the leakage of such electrolyte from the HEC cell. The effect of acidic or basic catalysis was studied using FT-IR absorbance spectroscopy. The bands in the siloxane region showed that more branched structure evolved when basic catalyst was used. The question of whether the structure of the electrolyte follows the same hydrolysis/condensation pattern when encapsulated between two substrates as in the open air was addressed. We prepared two kinds of in situ cells; for transmission IR measurement the electrolyte was encapsulated between two silicon wafers, while it was put between reflecting FTO glass and silicon wafer for IR absorption-reflection measurements. The measurements revealed the formation of methanol and silanol bands. In situ measurements above all revealed the great importance of the time after addition of catalyst at which the electrolyte is applied in the cell.

The research leading to these results has received funding from the European Community's Seventh Framework Programme (grant agreement n° 200431, INNOSHADE) and Centre of Excellence Low Carbon Technologies (Contract n° 3211-09-000641).

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DESIGN OF CAST STAINLESS STEELS WITH CONTROLLED DELTA FERRITE CONTENT

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Cast Fe-Cr-Ni-Mo based stainless steels (ASTM CF3, CF8 and CF8M) are commonly used in thermo-energetic objects for moderate thermally exposed components such as pipes, elbows, valves, flanges etc. The choice of these materials was driven from the possibility of centrifugal or sand casting of large complex shapes and their relatively good mechanical properties and resistance to corrosion. These materials have a duplex microstructure composed of ferrite and austenite. It is quite unstable non-equilibrium microstructure formed during cooling of castings. Ferrite represents typically 5 to 25 vol. % of the total. Actually, it is unstable delta ferrite because it is formed at high temperatures during alloy solidification and generally can not be transformed into the low temperature alpha ferrite (except with very long low temperature ageing). Delta ferrite spinodally decomposes with time at elevated working temperatures (above 300 °C). The result of this spinodal decomposition is thermal degradation of material; i.e. increase of hardness and strength but significant decrease of ductility and toughness. It is controlled primarily with delta ferrite content. Experimentally determined limit value is somewhere between 10 and 15 vol. % at working temperature 320 °C. At higher temperatures this value is significantly decreased. Therefore, it is necessary to know the ways of design and synthesis of cast stainless steels, which enable to produce the castings with suitable delta ferrite content. In the frame of the conference new Calphad based computer tools for the prediction of phase composition will be presented, as well as practical approach for the synthesis of cast stainless steels. Some comparisons between really determined delta ferrite contents and predicted with computer tools will also be presented.

USE OF NANOTECHNOLOGY FOR STABILITY ENHANCEMENT OF SELECTED ORGANIC PIGMENT

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Organic pigments, which have been available on market during the last 30 years, represent many interesting advantages for colour industry. The wide range of intensities and the many different nuances are among the most important properties in favour of organic pigments. Those characteristics make pigments applicable in different areas targeted by the colour industry (building materials, plastic and cosmetic products). In contrast, poor weather, UV and photocatalysis stability limit use of those pigments in products, which are exposed to stress conditions.

The aim of our work was to protect a selected red organic pigment (i.e., chloro diketo pyrrolo pyrrole) by a transparent nano layer in order to preserve its colouristic properties under stress conditions. Due to the necessity of high transparent shell material, silica was selected. The surface of diketopyrrolo pyrrole was previously modified by a surface active agent, by ethoxylated alcohol and by a combination of both modificators. Silica encapsulation was obtained by reaction of waterglass and hydrochloric acid. The morphology and grain size of encapsulated pigment particles were investigated by transmision electron microscopy (TEM). The effectiveness of protection against photocatalysis was measured by a fast irradiation method, developed inside the research group. The method based on exposure of TiO_2-organic pigments mixtures to UV radiation and measurement of colour change of the mixtures before and after irradiation.

The most protective layer against photocatalysis was achieved by modification with a combination of both chemicals and by a double or even triple encapsulation.

ANALYSIS OF CRACK FORMATION ON A SINGLE PART GLASS MOULD

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The analysis of the formation of longitudinal crack, which appeared on a single part glass mould, is presented in the work. The mould was made from AISI 314 steel, a temperature resistant stainless steel. The depth of the longitudinal cracks was approximately 3 mm. The cracks were divided into microcracks at the tip. Chromium and iron oxides were identified as was the presence of both sulphur and calcium. The crack had expanded transcrystalline due to stress corrosion. The fracture surface was gained by propagating existing cracks and shows a transcrystalline fracture due to hydrogen embrittlement. Atomic hydrogen, a product of corrosion, dissolves itself in the austenitic steel matrix at higher temperatures. The effect of hydrogen is so potent that it causes a brittle fracture in steel that is tough even at low temperatures. This kind of corrosion can cause transcrystalline cracks at only 50 % of the yield strength, the cracks are also affected by internal stresses. Even small stresses can cause the formation and advancement of stress corrosion.

THE EFFECT OF MECHANICAL ACTIVATION ON MULLITE FORMATION IN ALUMINA-QUARTZ CERAMICS SYSTEM

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Mullite ($3Al_2O_3 \cdot 2SiO_2$) is an important ceramic phase in conventional ceramics (such as tableware, construction ceramics, refractories), advanced high-temperature structural materials, heat exchangers, catalysator convertors, filters, optical devices and electronic packaging materials. However mullite suffers from their relatively low fracture toughness which limits their application in industrial use. The conventional route for preparation of mullite is the solid-state reaction between alumina and silica, which is controlled by diffusion. Mullite formation in this method takes place at a relatively high temperature (>1500 °C). The mullitisation temperature and the morphology of mullite particles depend on the particle size of the initial raw materials and the preparation processes of the precursors before sintering [1].

Mechanical activation of the starting materials is a promising method for the precursor's preparation. Particle size reduction, which increases the contact surfaces between the particles, is the direct consequence of milling. Also, the energy of the system increases and results in a decrease in the reaction temperature [2].

In this work, the effects of mechanical activation on structural disordering (amorphization) in alumina and quartz ceramics system were analyzed using X-ray diffraction (XRD) and scanning electron microscopy (SEM). Also, the degree of mullite crystallization for non-activated and activated alumina and quartz ceramic system was caculated using XRD.

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TRIBOLOGICAL BEHAVIOR OF PLASMA SPRAYED Al_2O_3-TiO_2 COATING

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Thermal spray technology has been widely used for a variety wear resistance applications in the several industrial areas. The objective of this work is that to enhance service life of machine component such as "shutters" used as a spare part of a textile workbenches by plasma coating, therefore, in this study, various types of Al_2O_3-TiO_2 plasma sprayed coatings were prepared on an aluminum based substrate. The commercial feedstock powders; 8 wt% Y_2O_3-stabilized ZrO_2 (Metco 204 NS-G), and Al_2O_3 (Metco 105 NS white) were supplied by SULZER METCO Powder Technology. NiCrAlY were supplied by GmbH. Al_2O_3 and ZrO_2 powders were premixed, respectively, to form four composite coatings, namely, 100 wt% YSZ (Z), 80 wt% YSZ-20 wt% Al_2O_3 (Z20A), 50 wt% YSZ -50 wt% Al_2O_3 (Z50A), 20 wt% YSZ -80 wt% Al_2O_3 (Z80A). The mixtures were ball-milled for 2 h by using ZrO_2 balls and distilled water as the milling media to provide homogenous mixtures. After drying, the powders were screened and sieved to the correct particle size distribution for plasma spraying. Particle size and chemical composition of the YSZ and the alumina starting powders are given in Table 1. Produced plasma powder compositions and their codes are given in Table 2. The effects of TiO_2 addition on the tribological and hardness properties of the coating were investigated. The dry reciprocoating sliding wear tests were performed under Al_2O_3 ball counter face of 10 mm in diameter with a load of 5 N, displacement amplitude 10 mm. Two different sliding speed of 0,1 and 0,15 ms^{-1} were applied respectively. Worn surfaces of the coatings were examined by SEM/EDS and stereo microscope after wear tests. The results show that the wear rate of the coatings were increased with increasing TiO_2 addition and sliding speed.

Table 1: Properties of zirconia and alumina starting powders

Powder	Chemical composition (wt%)				Size (μm)
	ZrO_2	Y_2O_3	Al_2O_3	SiO_2	
Zirconia	92	8	-	-	-106 +11
Alumina	-	-	95	5	-53 +15

Table 2: Produced plasma powder composition and their codes

Code	YSZ wt %	Al_2O_3 wt %
Z	100	0
Z20A	80	20
Z50A	50	50
Z80A	20	80

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PROCESSING PEEK (POLYETHER ETHER KETONE) ON 3D PRINTER FOR THERMOPLASTIC MODELING

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PEEK (Polyether ether ketone) is one of the high class industrial polymers. It is widely used in extremely demanding areas like automotive, aircraft and space industry. Because of the fact, that is also bio-compatible PEEK is also used for implants that are usually made with milling from a block of material. Article presents the attempt to process PEEK on 3D printer for thermoplastic modeling. Used procedure is one of the additive manufacturing procedures and as such it builds product by adding material layer by layer to get the finished product. Commercially available machines are unable to achieve the required melting and environment temperatures, so a new concept was developed. Machine was designed and build at company Ortotip d.o.o. and is able to produce parts up to 130 x 130 x 150 mm. After initial testing, probes according to standards ISO 527:1993 and ISO 178:2001 were produced and tested at facilities of the PEEK manufacturer. Presented are the machine for PEEK modeling, test methods and results of probe and parts production at different conditions.
Machine was developed to produce medical implants (specificity maxillofacial prosthesis) but with additional testing (that will help to improve mechanical properties of produced parts) practical all implants can be made with that procedure.

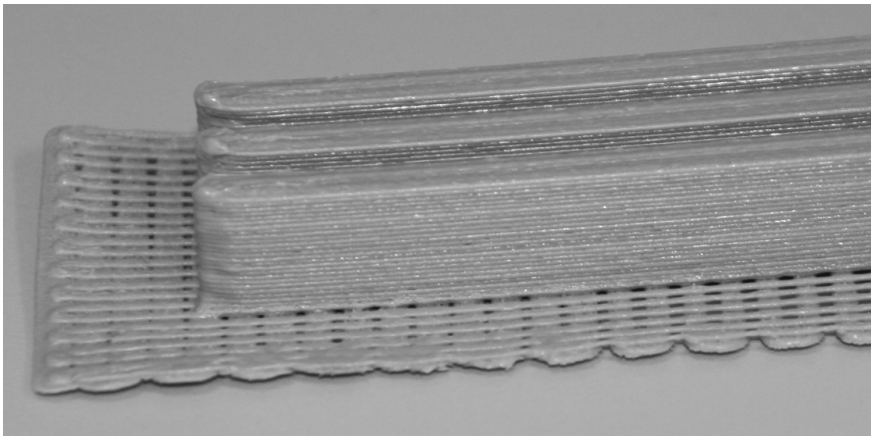

Figure 1: Part of the test probes made of bio-compatible PEEK polymer

INVESTIGATION OF WEAR PROPERTIES OF SLIDING PLATES USED IN RAILWAY VEHICLES

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Wear that causes respectable problems on industrial applications is a situation which resulted from those materials used come into contact with other materials (solid, liquid, and gas) and because of mechanical effects, small threads spread from the surface. Generally replacing a segment with a new one is not an economical circumstance. In addition, it brings about mechanisms in use to stop for a while. For these reasons, it reveals that wear resistant materials have to be used for the components of the mechanisms which are exposed to wear [1–3].

Sliding plates which are located on the bogies of railway vehicles are exposed to frictional environments during service and as a result of cyclic friction these elements of bogies are exposed to wear failure. In this study, Throdur 1730 steel used in railway vehicles was exposed to hard filet welding by using DIN 8555 E2-UM-60 Z- electrode by means of electric arc welding.

Two groups of specimen, original and filet welded were done destructive tests to determine their mechanical properties and to compare the welding effect on it. All specimens were exposed to uni-axial tensile testing, pin-on-disc wear tests and impact tests with different temperatures. Microstructures of specimens were determined and characterized by SEM and optical microscope, mechanical properties and ductile-to-brittle temperatures of two groups of specimens were detected.

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SURFACE OXIDATION OF HEATING RESISTORS IN GLOW PLUGS

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Glow plugs in the automotive industry use heating resistors made of FeCrAl alloys. Metals and alloys exposed to high temperature react with the surrounding environment, resulting in high temperature corrosion. Oxidation is the most important high temperature corrosion reaction. Some high temperature alloys use aluminum to form an Al_2O_3 protective layer for oxidation resistance. In temperature range above 1200 °C SiO_2 and Al_2O_3 are two oxides that are capable of forming a potent protective barrier against further oxidation. The alloy normally requires above 4 % Al to form a continuous protective layer.

Protective oxide layer grow on the surface of the heating resistors and the growth depends on several parameters, such us temperature and time of the heat exposure, the atmosphere of the heat treatment (partial pressure of oxygen), share of the Al in the matrix material, etc. For the heating resistors FeCrAl alloys, so called Kanthal AF, with and without rare earth elements are used.

The phenomenon of the growth of the Al_2O_3 on the surface of the heating resistors is the diffusion of the Al from the bulk material onto the surface. The diffusion is not constant during the oxidation process due to the oxide growth on the surface. Thermodynamically, an oxide is likely to form on a metal surface when the oxygen potential in the environment is higher than the oxygen partial pressure in equilibrium with the oxide.

In this paper we have investigated the natural phenomena of the Al_2O_3 growth on the surface prepared by different parameters to achieve the continuous protective layer on the surface of the heating resistors. SEM/EDXS mapping analysis were performed to confirm the element distribution on the cross section of the resistors heat treated in air or pure oxygen, or in humid H2/Ar atmosphere, different time and temperature, to achieve the optimum distribution of the oxide layer. The results of different heat treatments are compared in this work.

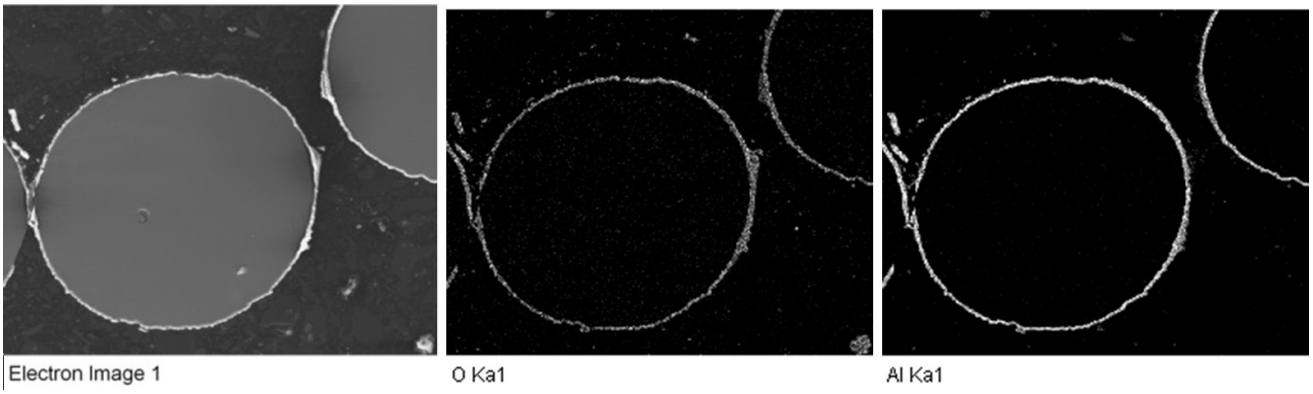

Figure 1: EDXS mapping of the Oxide and Aluminum distribution of the elements on the cross section of the heating resistor. Sample was heat treated in air at 1250 °C, furnace heated and cooled.

CALCULATION OF Al-COIL TEMPERATURE DISTRIBUTION DURING HEAT TREATMENT

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Heat treatment of Al coils is essential process to achieve desired microstructural and consequently mechanical properties of coils for further rolling process or for final product properties. For a given alloy, temperature evolution over time during heat treatment is crucial driving force for microstructural changes and therefore it is essentially to know the spatial evolution of coil temperature during heat treatment if the heat treatment-process is to be optimized.
The measured coil was equipped in advance with two lines of thermocouples (5 in each line), which were inserted in the coil during rolling at different radius. Additional thermocouples were inserted near the coil surface on several critical points in the geometry. One of the goals of the measurements was to identify hot spots on the coil. For deeper study of coil spatial temperature evolution, a 2-dimensional mathematical model was developed and calibrated on measured temperatures in the coil during routine heat treatment. Temperature conduction inside coil is calculated using finite-difference method, while boundary condition is measured air-temperature. Al-coil can easily have some 1000 wraps, which cause drop of thermal conductivity in radial direction with increasing number of wraps. Therefore, different thermal conductivities for each direction are considered in the model. The developed model is currently used to study different reheating strategies as well as temperature distribution inside strip and its influence on strip properties. Such model is an efficient tool to study influence of heat treatment on microstructural and mechanical properties distribution along strip length.

BEHAVIOUR OF SMALL CRACKS EMANATING FROM TINY DRILLED HOLES

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In what manner cracks initiate and propagate from artificial and real small defects in different metals was was solved in the past. It is found that both the hardness and the parameter $\sqrt{area}$ are crucial. The magnitude of $\sqrt{area}$ is square root of the defect projection onto the plane of cyclic stress; hardness is expressed as HV-number. No attention was given in the past to the effects of the local residual stresses that are result of the small defects origin. Of course, the level and the configuration of local residual stresses affect the crack initiation and the early propagation of the just initiated small crack. Acceleration or retardation of both are reflected in the fatigue limit of material with small defects. The influence of the local residual stresses caused by hole drilling in relation to the crack initiation and subsequent short crack propagation in artificially prepared coarse-grain martensitic heat-affected zone is experimentally studied. Small defects affecting the coarse-grain heat-affected zone fatigue limit could be an undersized lack of fusion, inclusions, precipitations, tiny cracks and undercuts. The origins of the small cracks in the coarse-grain heat-affected zone are cold, liquation and reheat cracking or the beginning of lamellar tearing. A stress field can be restored around the natural small defects; for example, different thermal expansion coefficients of the inclusions with respect to the steel during cooling, an enhanced residual stress field due to the stress concentration caused by pores, the tensile stress at the cold crack tip due to reversed plastic-zone formation, etc. The size of the used holes in the present investigation was comparable to the grain size. So, they are tiny drilled holes. Specimens with and without a local residual stress field were tested on a rotary bending machine at the global R-ratio = -1. Specimens with the just drilled holes were specimens in the residual stress condition while specimens in the residual-stress free condition were thermally treated after drilling. A focused ion beam and a scanning electron microscope were used to reveal the influence of existing residual stresses field on the stress level applied necessary for crack initiation and early propagation. The existing local residual stress field emerged by drilling suppresses crack initiation. When the crack initiates early small-crack propagation is accelerated by the residual stress-field. At the stress level equal fatigue limit the crack becomes a non-propagating crack. Small crack propagation rates up to that stage were detected. At levels higher than the fatigue limit the crack begins to behave as a long crack.

SYNTHESIS OF NOVEL CATALYSTS SUPPORTS BASED ON EPOXY AND TIOEPOXY RESINS CURED WITH IONIC LIQUIDS

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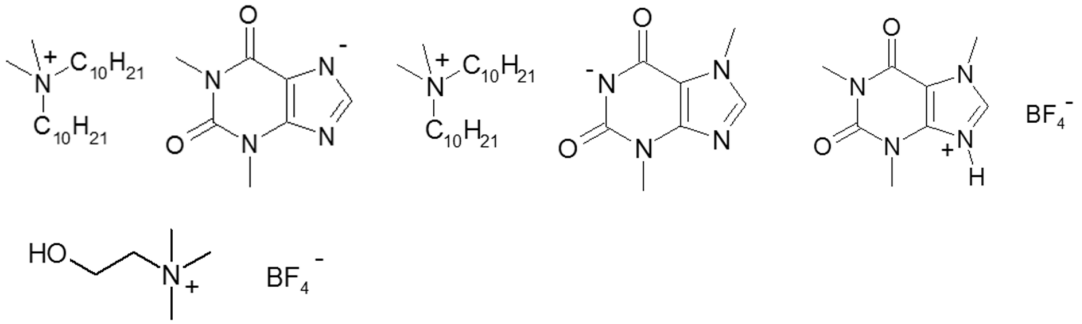
In recent years the design and synthesis of highly functionalized polymers as supports for metal catalyst is on great importance. These materials comparing to their soluble homogenous anologues offer several practical advantages such as easy separation from the reaction mixture and recycling.

In this report we would like to present the synthesis of novel catalyst supports based on epoxy and thioepoxy resins. Modification of epoxy and thioepoxy resins was carried out using ionic liquids containing imidazole moieties and/or tertiary ammonia salts (scheme 1). This procedure leads to easy and controlled insertion of bonding groups to the polymeric structure, without further resin functionalization. The metal complex $PdCl_2(PhCN)_2$ was introduced to the matrix via ligand exchange reaction. In order to characterize the heterogeneous complexes before and after use X-ray photoelectron spectroscopy XPS, infrared spectroscopy IR and ^{13}C NMR spectroscopy were used. The novel, epoxy and thioepoxy resins-based matrices as supports for palladium catalysts were investigated. Stability, selectivity and recycling efficiency in hydrogenation of cinnamaldehyde and Heck reactions were determined.



Scheme 1. Structures of used ionic liquids.

PRODUCTION OF SEAMLESS TUBES FOR HYDRAULIC APPLICATION

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During the production of specific hydraulic tubes with larger wall thickness could appear condition by which is high risk to obtain heterogeneous wall thickness and undulation of the inner surface.
In the article are presented measurements after different production operations of hydraulic tubes such as hot rolling, cold drawing and deep rolling. Observed was also influence of production operations on heterogeneous wall thickness and undulation of inner surface.
As a result of the research is presented cause of creation undulation on inner surfaces of the tubes and possibilities how to prevent or moderate creation of undulation on inner surface.

DURABILITY OF POZZOLANIC CEMENT IN SODIUM SULFATE AND MAGNESIUM SULFATE SOLUTION

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This study has examined the effect of sodium sulfate and magnesium sulfate solution on mortar prepared with pozzolanic cement designated as CEM IV/B-W 32,5 N according to EN 197-1. This pozzolanic cement is a mix of calcareous fly ash and portland cement clinker.
The resistance of mortar to the sulfate attack was investigated and evaluated using the Koch-Steinegger test. Strengths of mortar specimens immersed in 4,4 % Na_2SO_4 and 3,73 % $MgSO_4$ solutions were determined and compared with those samples immersed in deionised water. The results showed that mortar with pozzolanic cement is sulfate resistant. However, there is a difference in the initial strengths depending on which solution, deionised water or lime – saturated water, was used for curing the specimens prior the test. Deionised water behaves as aggressive solution as compared to lime – saturated water.

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