

Materials Science & Technology Conference and Exhibition 2015 (MS&T'15)

Columbus, Ohio, USA
4-8 October 2015

Volume 1 of 2

ISBN: 978-1-5108-1393-9

Printed from e-media with permission by:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571



Some format issues inherent in the e-media version may also appear in this print version.

Copyright© (2015) by Materials Science & Technology (MS&T)
All rights reserved.

Printed by Curran Associates, Inc. (2015)

For permission requests, please contact the Association for Iron & Steel Technology (AIST)
at the address below.

Association for Iron & Steel Technology (AIST)
186 Thorn Hill Road
Warrendale, PA 15086-7528

Phone: (724) 776-6040

Fax: (724) 776-1880

mdidiano@aist.org

Additional copies of this publication are available from:

Curran Associates, Inc.
57 Morehouse Lane
Red Hook, NY 12571 USA
Phone: 845-758-0400
Fax: 845-758-2634
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

Contributed Papers from Materials Science & Technology 2015

Edited Manuscripts

Actinide and Lanthanide Materials

Influence of the Chemical Composition Variations on Densification during the Sintering of MOX Materials	5
<i>S. Vaudeza, C. Marlot, and J. Lechelle</i>	
Study of the Swelling Phenomenon during the Sintering of $Ce_{0.85}Y_{0.15}O_{2-x}$ in Reducing Atmosphere	13
<i>C. Chambon, S. Vaudez, C. Avenel, C. Marlot, and J. Heintz</i>	
Studies on the Behaviors of Thermal Oxidation on Ce Metal	21
<i>L. Luo, S. Yang, C. Jiang, X. Lai, and X. Wang</i>	
Systematic Actinide Reduction in Thermal Nuclear Reactors	25
<i>L. Mateescu, N. Kadambi, and N. Ravindra</i>	

Additive Manufacturing of Metals: Microstructure, Material Properties, and Product Performance

Effect of Process Parameters on the Microstructural Evolutions of Laser Cladded 420 Martensitic Stainless Steel	35
<i>M. Alam, J. Urbanic, S. Saqib, and A. Edrisy</i>	
The Microstructure and Mechanical Properties of 17-4 Stainless Steel Fabricated by DMLS	55
<i>B. Almangour and J. Yang</i>	
DMLS (Direct Metal Laser Sintering) 4340 Steel: Influence of Starting Particle Size	63
<i>E. Jelis, R. Sadangi, M. Hespos, S. Kerwien, M. Clemente, and N. Ravindra</i>	
Influences of Post Processing on Laser Powder Bed Fused Ti-6Al-4V Part Properties	69
<i>S. Jahn, V. Seyda, C. Emmelmann, and S. Sändig</i>	
Effect of Heat Treatment on the Microstructure and Corrosion Behavior of Ti6Al4V via Direct Metal Laser Sintering	77
<i>Y. Xu, Y. Lu, Y. Rong, and R. Sisson, Jr.</i>	
The Effect of Annealing on the Microstructure, Mechanical Properties and Corrosion Behavior of Ti-6Al-4V via Direct Metal Laser Sintering	85
<i>Y. Xu, Y. Lu, K. Sundberg, and R. Sisson, Jr.</i>	
Corrosion of 3D Printed Steel	93
<i>D. Schmidt, E. Jelis, M. Clemente, and N. Ravindra</i>	
Additive Manufacturing of Aluminum Alloy with High Silicon Content	101
<i>E. Hilpert and S. Risse</i>	
On the Laser Additive Manufacturing Repair of UNS S41000, UNS S17400 and UNS S32750 by UNS N06625	109
<i>M. Marya, S. Marya, V. Singh, P. Sadik, and J. Hascoet</i>	

Additive Manufacturing: In-situ Process Monitoring, Defect Detection and Control

A Systematic Approach to Manufacturing Parts with Desired Properties by Selective Laser Melting	121
<i>I. Yadroitsev, P. Krakhmalev, and I. Yadroitsava</i>	

Geometric Model to Predict Porosity of Part Produced in Powder Bed System	129
<i>M. Tang, P. Pistorius, and J. Beuth</i>	

In-situ Process Monitoring of Vacuum Brazing Using an Electrical Resistance Measurement	137
<i>W. Tillmann, N. Sievers, R. Zielke, M. Kuck, and B. Lehmert</i>	

Advanced Coatings for Wear and Corrosion

Effect of the Temperature of Plasma Nitrocarburizing on the Microabrasive Wear Resistance of the AISI 304 Stainless Steel	147
<i>P. Cisquini, A. Franco Jr., and E. Vieira</i>	

Property Evolution in the Electroless Nickel Plating of a Spinodal Copper–Nickel–Tin Alloy	155
<i>Y. Lu, M. Marya, and V. Singh</i>	

Coating on Performance	163
<i>D. Heumannskaemper, M. Pavoni, A. Vohra, H. Ebhardt, R. Chitalkar, and M. Ng</i>	

Remarkable Improvement in Properties of Ni-B Coatings by the Addition of Mixed Oxide Nanoparticles	171
<i>R. Shakoor and A. Radwan</i>	

Dry Sliding Wear Behavior of Low-Temperature Plasma Carburized AISI 420 Steel	179
<i>C. Scheuer, R. Cardoso, J. das Neves, and S. Brunatto</i>	

Method Development for Assessing Stress Corrosion Cracking of Magnesium Alloy Subassemblies	187
<i>X. Pang, Y. Zeng, C. Shi, and J. McKinley</i>	

Development of Polyaniline-Polycarbonate Composite Coatings for Anti-Corrosive Applications on Mild Steel	195
<i>K. Tekade and R. Rathod</i>	

Investigation of Corrosion Performance of ZREP Modified by Polyaniline Doped with Camphorsulfonic Acid	205
<i>X. Li, D. Yang, and H. Castaneda-Lopez</i>	

Simple Fabricating Superamphiphobic Polymer Composite Coatings with Multifunction	219
<i>H. Wang, Y. Zhu, and H. Song</i>	

Advanced Chromoaluminizing Coatings for Heat-Resistance on Composite Materials under SHS	229
<i>B. Sereda and D. Sereda</i>	

Influence of the Layer Thickness of the S Phase on the Abrasive Wear Resistance of Plasma-Nitrided AISI 316L Austenitic Stainless Steel	233
<i>E. de Börtoli, E. Vieira, and A. Franco Jr.</i>	

Stability Evaluation of Cerium(III) Nitrate Inhibitor in a BTSE Silane Solution as Different pHs for Coating and Corrosion Protection of Galvanized Steel	241
<i>A. Gabbardo and J. Ferreira</i>	

Advances in Metal Casting Technologies

The Effect of Fe-Rich Intermetallics on Mechanical Properties of Squeeze Cast Al-5.0Cu-0.6Mn Alloys with High Content of Fe	251
<i>W. Zhang, B. Lin, D. Zhang, and C. Yang</i>	

On the Primary and Eutectic Grains in Thin Wall Ductile and Compacted Graphite Iron Castings	259
<i>M. Górný, M. Kawalec, and G. Sikora</i>	

Numerical Study on the Dispersion of Ceramic Nanoparticles during Ultrasonic Processing and Solidification of 6061-Based Nanocomposites	267
<i>D. Zhang, S. Jia, P. Allison, and L. Nastac</i>	
Innovative Technology to Cast Thin Wall and Geometrically Complex Aluminum-Based Alloy Castings	275
<i>A. Salman and L. Nastac</i>	
Development of a Measurement Concept for the Validation of the Numerical Optimization of High Pressure Die Casting Dies	283
<i>F. Schmidt, Y. Queudeville, U. Vroomen, and A. Bührig-Polaczek</i>	
Study on Argon Back Pressure for Stopper Rod with Calibrated Pipe	291
<i>S. Zhan, J. Bae, J. Choi, and R. Phillips</i>	
Primary Dendrite Arm Spacings in Al-7Si Alloy Directionally Solidified on the International Space Station	301
<i>S. Angart, M. Lauer, D. Poirier, S. Tewari, R. Rajamure, and R. Grugel</i>	
Development of a Zircon-Free Shell Mould System for the Investment Casting of Turbine Blades	311
<i>R. Solanki, S. Blackburn, S. Welch, and J. Knight</i>	
Increase Pressure and Homogeneity of Castings from EN AC 47100 Alloy	319
<i>S. Gaspar, J. Pasko, and S. Pavlenko</i>	

Avant-garde Developments in the Processing, Properties and Performance of Multifunctional Ceramic- and Metal-Matrix Composites

Study of the Microstructure and Mechanical Properties of Locally Developed Carbon Fiber-Silica Sand Nanoparticles Aluminium Based Hybrid Composites	329
<i>T. Ahmad, M. Kamran, R. Ahmad, and T. Butt</i>	
Updating the Definition and Concepts in the Field of Composite Materials	337
<i>M. Pech-Canul and S. Valdez</i>	
Kintetic Study of HYSY-CVI Deposited Si ₃ N ₄ /SiO ₂ Ceramic Matrix Composite	347
<i>N. Soltani, M. Pech-Canul, L. González, and A. Bahrami</i>	
Microstructure and Properties of Bilayer-Graded Al-Matrix Composites by One-Step Pressureless Infiltration of SiC/Rice Husk Ash Preforms	355
<i>A. Bahrami, M. Pech-Canul, N. Soltani, and C. Gutierrez</i>	

Degradation of Nonmetallic Materials

The Effect of Reinforced Epoxy, Vinyl Ester and Phenolic Structures on Their Cavitation Erosion Behavior in Seawater	367
<i>A. Al-Hashem, H. Tarish, and N. Tanoli</i>	

Joining Dissimilar Materials for Energy and Mass Optimization for the Transportation Industry

Preliminary Investigations Using Refractory Metal Interlayers for Joining Titanium and Stainless Steel Sheet Stock	377
<i>J. Gould, W. Peterson, and J. Jennings</i>	
Interfacial Structure Analysis on Direct Bonding Material of Metals with CFRP	385
<i>H. Imai, K. Kondoh, T. Izawa, and J. Umeda</i>	

Joining of Advanced and Specialty Materials (JASM XVII)

Effect of Ga on the Inoxidizability Andwettability of Sn-0.5Ag-0.7Cu-XGa Solder	393
<i>X. Songbai, L. Dongxue, X. Peng, X. Jiachen, and W. Jianxin</i>	
Reactive Partial Transient Liquid Phase Bonding (R-PTLPB) of YSZ to Crofer22APU Using Nickel and Copper-Nickel as Core Interlayers	403
<i>W. Tillmann, C. Schaak, and J. Pfeiffer</i>	
Stereolithographic Additive Manufacturing of Micro Photonic Crystals for Terahertz Wave Control	411
<i>S. Kiriwara and K. Nonaka</i>	

Materials Degradation in Oil & Gas Applications

Hydrogen Induced Stress Cracking (HISC) in the Oil & Gas Industry	421
<i>H. Amaya and A. Din</i>	
Demonstration of Hydrogen Sulfide Fugacity as a Primary Factor in Environmentally-Assisted Cracking and Recommendations on Retaining Conservatism in Sour Qualification and Design	429
<i>B. Chambers, S. Huizinga, W. Grimes, B. Miglin, and R. French</i>	
Effect of Crystallographic Texture and Grain Size on Crack Formation during Cold Rolling of API 5L X70 Steel	439
<i>M. Masoumi, C. Silva, L. Catorceno, and H. de Abreu</i>	
Extending the Creep Life of a High Temperature Refinery Reactor	449
<i>G. Wilks</i>	

Materials Selection for Chemical Process and Other Aggressive Environments

Combined Influence of Metal and Chloride Ions on the Corrosion of Titanium as Elevated Temperatures	467
<i>J. Liu, Y. Liu, A. Alfantazi, and E. Asselin</i>	
The Effect of UNS G1095 and UNS F41003 Alloys Microstructure on Their Cavitation Erosion Behaviour in Seawater.....	479
<i>A. Al-Hashem, H. Tarish, and N. Tanoli</i>	
The Corrosion-Resistant Nickel Alloys – A Review	487
<i>P. Crook and R. Rebak</i>	
Effect of Heat Treatment on the Corrosion Resistance of High Chromium and High Carbon Stainless Steel	509
<i>S. Benjamin and S. Kazmi</i>	

Measurement and Modeling of High Strain-rate Deformation

A Finite Element Based Approach to Deformation of Encapsulated Particles in Cold Spray	519
<i>J. Schreiber, I. Smid, and T. Eden</i>	
Finite Element Analysis for Short Crack with Different Inclusion Positions during the Hot Rolling Process of Low Carbon Steel	527
<i>B. Wang, J. Zhang, Y. Yin, Z. Wang, W. Song, and C. Xiao</i>	
Formability of AA5182-O Sheet during Electro-Hydraulic Forming: Influence of Input Energy	535
<i>A. Jenab, D. Green, A. Alpas, and K. Boyle</i>	

Multi Scale Modeling of Microstructure Deformation in Material Processing

A Numerical Investigation of the Effect of Texture on Mechanical Properties of Dual Phase Steel Using a Dislocation-Based Crystal Plasticity Model	545
<i>H. Lyu, A. Ruimi, F. Zhang, and H. Zbib</i>	
Identification of Yield Function for 5000 Series Aluminum Alloy Sheet by Numerical Biaxial Tensile Testing Using Homogenized Crystal Plasticity Finite Element Method	553
<i>A. Yamanaka, K. Hashimoto, J. Kawaguchi, T. Sakurai, and T. Kuwabara</i>	
Data Acquisition in 3D Tomography for Multiscale Microstructure Model Construction under Uniaxial Compression	561
<i>X. Lu and L. Chan</i>	
Microscale Image-Based Finite Element Modeling of High Speed Steel Microstructure	567
<i>K. Redkin, C. Hrizo, and C. Garcia</i>	
Multiscale Modelling of Precipitation Strengthening Effects in Microalloyed Steel Subjected to Cyclic Deformation	579
<i>P. Graca, K. Muszka, J. Majta, and Ł. Madej</i>	
Temperature-Dependent Mechanical Properties of Shape Memory Polymer Composites Reinforced with Shape Memory Alloys	587
<i>S. Pulla, H. Karaca, and Y. Lu</i>	
Contribution of Ordered-Inordered Phenomenon within the Interphase Region toward Increasing Elastic Modulus in CNT/Polymer Nanocomposites	595
<i>A. Zeraati and H. Hosseinabadi</i>	
Large-Scale Multi-Phase-Field Simulation of Polycrystalline Grain Growth with Finely Dispersed Particles	603
<i>M. Okamoto, A. Yamanaka, T. Shimokawabe, and T. Aoki</i>	
Modeling Deformation in Material Processing and Laws of Phasic by SHS Pressing Intermetallics Alloys	611
<i>B. Sereda and D. Sereda</i>	
Comparison of 3D and 2D Digital Material Representation Channel Die Compression Results	619
<i>J. Szyndler and Ł. Madej</i>	
<u>Phase Stability, Diffusion Kinetics, and Their Applications (PSDK-X)</u>	
Plasticity-Enhancement of Steels by Q&P Processing	629
<i>B. De Cooman, E. Seo, L. Cho, and M. Javad</i>	
Stability of Retained Austenite in Quenched and Partitioned Steel Wires	637
<i>C. Mesplont and C. Resende</i>	
The Material Mechanism of Hydrogen/ Vacuum Annealing on Soft Magnetic Properties for 1J50 Alloy	645
<i>Y. Zhang, G. Wang, Y. Zhong, and Y. Rong</i>	
Designing a Model for Polymeric Binder Degradation, Volatilization and Diffusion through Porous Media	651
<i>J. Prati, M. Matthewson, and R. Haber</i>	
Investigations of Interdiffusion in Titanium-Niobium Alloys	661
<i>V. Verma and K. Kulkarni</i>	

Steels for Oil and Gas Sectors: Advances in Metallurgy, Processing, and Performance

Challenges Facing Today's Oil and Gas Pipelines	671
<i>S. Rapp and R. Scoles</i>	
High Quality Steels for the Manufacturing and Processing of High Frequency Welded Line Pipe	677
<i>T. Lawrence and P. Adhikari</i>	
Analysis of Mechanisms Triggering Brittle Process in the Ductile-Brittle Regime in HSLA Steels	685
<i>D. Jorge-Badiola, P. Uranga, C. Reip, and J. Rodriguez-Ibabe</i>	
The Effect of Hot Rolling Process and Chemical Composition on the Mechanical Performance of API J55 Steel	693
<i>B. Ma, H. Seong, Y. Gong, and A. DeArdo</i>	
Multi-Scale Ductile Fracture Modeling for Dual-Phase High Strength Steel – Part 1: Characterization of Dual-Phase High Strength Steel for Improved Toughness and Deformability	701
<i>S. Ota, J. Shimamura, K. Yasuda, N. Ishikawa, M. Liu, C. Degen, and Y. Wang</i>	
Multi-Scale Ductile Fracture Modeling for Dual-Phase High Strength Steel – Part 2: Damage Mechanics Analysis on Charpy Impact Toughness of Dual-Phase High Strength Steel	709
<i>M. Liu, C. Degen, Y. Wang, S. Ota, J. Shimamura, K. Yasuda, and N. Ishikawa</i>	
Development of Pipe Steels for Energy and Change of Mechanical Properties during Pipe-Making	717
<i>C. Lee, W. Kim, M. Joo, H. Jung, and J. Bae</i>	
Pipe Yield Strength Measurement Using Flattened Straps	725
<i>W. Walsh, B. Ehrhardt, S. Nast, L. Kompotiatis, and T. Huffman</i>	
Separation Phenomenon of Drop Weight Tear Test in High Toughness Linepipe Steel	733
<i>J. Ding, X. Liang, and S. Jiao</i>	

Unedited Manuscripts

Advanced Coating Materials for Energy and Environmental Applications

Fabrication of Semitransparent Photovoltaic Cell by a Cost Effective Technique	747
<i>K. Nithyayini and S. Ramasesha</i>	
Degradation of Crucible Properties and Impact on Energy Consumption during Operation	755
<i>M. Pavoni</i>	

Advanced Manufacturing Technologies

Fine-Grained Mg-Y-Nd Alloy with High-Strain-Rate Superplasticity Produced by Submerged Friction Stir Processing	765
<i>Z. Datong and C. Genghua</i>	
Effect of Heat Treatment on Microstructural Inhomogeneity of Constrained Groove Pressed Cu-Zn Alloy	771
<i>P. Yadav and S. Shekhar</i>	
Continuous Rotary Extrusion of Magnesium Alloy Az 91	781
<i>M. Mitka, W. Misiolek, M. Lech-Grega, M. Gawlik, M. Bigaj, and W. Szymanski</i>	
Mathematical Modelling of Cutting Forces in Slab Milling of Super Alloy (Nickel)	789
<i>S. Ojolo, S. Ekundare, and O. Adesina</i>	

Chopped Carbon Fibers as Pore-Forming Agent to Fabricate the Integral Ceramic Mold	803
<i>K. Miao, Z. Lu, Z. Ji, H. Zhang, and D. Li</i>	
Laser Materials Processing Using a Multiple Wavelength Hybrid Beam	811
<i>J. Hillman, Y. Sukhman, and C. Risser</i>	
Application Driven Process Selection	817
<i>J. Dale</i>	
Prospects of Continuous Rotary Extrusion (CRE) of 6xxx Series Aluminum Alloys with Vanadium Addition Obtained by Rapid Solidification (RS)	827
<i>M. Gawlik, M. Lech-Grega, W. Szymański, M. Mitka, M. Bigaj, and M. Szymanek</i>	
An EBSD Study of Nickel Sheets after Unidirectional and Cross Rolling ARB Processings	835
<i>J. Duan, M. Quadir, and M. Ferry</i>	
Characterization of Rapidly Solidified Commercial Grey Cast Iron in Drop-Tube	843
<i>O. Oloyede, T. Biggs, and A. Mullis</i>	

Advanced Steel Metallurgy: Products and Processing

New Product Developments in JSPL, India	853
<i>R. Ajmeria</i>	
Formability of 0.2%C–1.5%Si–(1.5–5)%Mn TRIP-Aided Annealed Martensitic Steels	859
<i>K. Sugimoto, K. Koyama, and H. Tanino</i>	
Temperature Evolution and Phase Transformations during Controlled Cooling of AHSS Hot Band Coils	869
<i>E. Poliak, W. Umlauf, S. Atreya, J. Brannbacka, O. Girina, T. Logan, J. Wotowiec, D. Price, and H. Jun</i>	
Effects of Niobium and Vanadium on Hot-Rolled Q&P Steel Microstructures Simulated via Gleeble	877
<i>A. Araujo, J. Speer, G. Thomas, and E. De Moor</i>	
The Effect of Nb on Low-Carbon Martensitic Steel Properties through Prior Austenite Optimization	885
<i>L. Bracke, E. Leunis, L. Sanchez, and S. Jansto</i>	
Effect of Annealing on the Microstructure and Properties of Two Medium Manganese Steels	893
<i>B. Sun, H. Aydin, F. Fazeli, and S. Yue</i>	
Effect of Spatial Distribution of Martensite on Strength of Dual Phase (DP) Steel	901
<i>F. Zhang, A. Ruimi, and D. Field</i>	
Hot Deformation Behaviour of 16Cr-5Ni Martensitic Stainless Steel	909
<i>B. Kishor, G. Chaudhari, and S. Nath</i>	
Sheared-Edge Ductility/Hole-Expansion Ratio Testing of Advanced High-Strength Steels	917
<i>P. Soloski, N. Thimons, A. Marks, J. Hartle, Q. Trest, A. Johnston, W. Perisse, and A. DeArdo</i>	
Effect of Cooling Conditions on Micro-Structure of Tyre Cord Steel	927
<i>D. Guo, C. Garcia, H. Gao, B. Zhao, A. Rainier, S. Aihua, B. Wang, Z. Bo, and M. Liguó</i>	
Effect of Microstructure on Tensile Properties and Cut Edge Formability of DP, TRIP, Q&T and Q&P Steels	939
<i>D. Fan, H. Jun, and N. Fonstein</i>	
HRTEM on the Precipitates in V-Added DP980 Steel	947
<i>M. Hua, Y. Gong, M. Gordillo, R. Glodowski, and A. DeArdo</i>	

Bainite Transformation Behavior of Simulated CGHAZ in Low Carbon High Strength Steels	955
<i>J. Shimamura, N. Ishikawa, and S. Toyoda</i>	
Induction Quenching of Steel 100CrMnSi6-4: Coarse vs. Fine Structure in View of Transformation Kinetics	961
<i>J. Dlouhý, D. Hauserová, and M. Kövér</i>	
Improving the Batch Annealing of Microalloyed Cold Rolled HSLA Steels	969
<i>C. Fang, M. Hua, S. Choi, and A. DeArdo</i>	
Relevance of Time between Last Deformation Pass and Accelerated Cooling on the Microstructural Refinement in Nb and Nb-Mo Microalloyed Steels	981
<i>G. Larzabal, N. Isasti, J. Rodriguez-Ibabe, and P. Uranga</i>	
Dynamic Recrystallization Behavior of 0.03-Nb 0.02-Ti Microalloyed Low Carbon Steel	989
<i>Z. Mei, G. Bin, Z. Yan, Z. Yong, and L. Lin</i>	
Effects of Thermomechanical Processing and Vanadium Additions on Microstructures and Properties of High Strength Dual Phase Steels Processed with Continuous Galvanizing Line Simulations	995
<i>Y. Gong, M. Hua, J. Uusitalo, and A. DeArdo</i>	
Mechanism for Vibration Excitation Nucleation Technology to Improve Solidification Structure in Upper Part of Ingot.....	1007
<i>H. Zhang, C. Wang, and M. Wang</i>	
The Role of Tundish Design on Residence Time Distributions (RTD) and Slag Entrainment Phenomena	1015
<i>A. Dutt and D. Mazumdar</i>	
Numerical Model of Dephosphorization Reaction Kinetics in Top Blown Converter Coupled with Flow Field	1023
<i>A. Wang, W. Liu, J. Li, and S. Yang</i>	
Research of Arsenic Removal in Molten Steel	1033
<i>L. Luo, J. Wang, H. Wang, L. Zhou, and Z. Li</i>	
Formation and Microstructure of Oxide Scale in Carbon and Low-Alloy Steels during Continuous Casting	1039
<i>N. Wang, S. Yu, J. Xu, M. Chen, and C. Huang</i>	
Metallurgical Implications during the Production of Peritectic Structural Flat and Long Products	1047
<i>S. Jansto</i>	
Evolution of Non-Metallic Inclusions in 316L Stainless Steel during Refining and Casting Process	1055
<i>X. Yin, Y. Sun, Y. Yang, X. Deng, M. Barati, and A. McLean</i>	
Numerical Simulation of Slag Entrainment Caused by Vortex in Ladle	1063
<i>S. Wang, J. Zhang, Z. Wang, and W. Song</i>	
Improvements of Toughness and DC Magnetic Property in Fe-Si Alloy by Mn Substitution	1071
<i>T. Mizuguchi, R. Yamamoto, and T. Ito</i>	
Application of Intensive Quenching Process for Steel Mill Rolls Made of Ductile Iron	1077
<i>M. Aronov, N. Kobasko, J. Powell, H. Kim, B. O'Rourke, and B. Andreski</i>	
Methods for Reaching Outstanding Flatness on 3 and 4mm Hardox	1085
<i>A. Philipsson and A. Carlestam</i>	
Analysis and Control of the Slag Entrainment Defects of HP295 Steel Plate for Welded Gas Cylinder	1093
<i>L. Yanzhao, P. Zaigang, L. Haibo, N. Youjin, and G. Pan</i>	

Basic Research of High Efficient Extraction of Vanadium from Hot Metal with High Titanium by BOF	1101
<i>H. Fan, D. Chen, L. Bai, M. Long, X. Du, and H. Long</i>	
Analysis and Practices for the Center Hole of Steel Ingot in Alloy Welding Wire Steel	1109
<i>C. Jiang</i>	
Comparative Study on Metallurgical Properties of Semicoke and Lump Coal Used in COREX	1117
<i>Y. Zhou, J. Zhang, R. Xu, D. Zhao, G. Wang, K. Jiao, and Y. Liu</i>	
Effect of Vanadium Titanium-Magnetite Content on Metallurgical Properties and Microstructure of V-Ti Bearing Sinter.....	1125
<i>Y. Wang, J. Zhang, Y. Zhang, D. Liu, and Z. Liu</i>	
Mathematical Simulation of Fluid Flow and Inclusion Behavior in a Tundish Equipped with Flow Modifiers	1133
<i>M. Pérez-Labra, Á. Ramos-Banderas, E. Ávila-Dávila, J. Romero-Serrano, F. Barrientos-Hernández, M. Reyes-Pérez, and J. Hernández-Ávila</i>	
Formation and Motion Behavior of Bubble during Ladle Refining with Bottom Blowing	1143
<i>Y. Huang, J. Li, S. Yang, and W. Liu</i>	
Mechanism and Influence Research of MnO on the Flushing Blast Furnace Slag	1153
<i>B. Dai, K. Liang, X. Wang, G. Hui, and H. Dong</i>	
Numerical Simulation of Vacuum Remelting Process for Cr-Co-Mo-Ni Gear Steel	1161
<i>C. Hou, J. Li, S. Yang, X. Gao, and W. Liu</i>	
Precipitation Behavior of Nanoscale Carbides in Ferrite after Different Tempering Processes in Ti-Mo Microalloyed Steel	1169
<i>X. Wang, F. Bu, S. Yang, and C. Shang</i>	
Research on the Development and Application of Advanced Steel Materials for High-Speed Rail EMU Axle	1177
<i>L. Xingui, W. Yi, Z. Bin, and X. Bin</i>	
Simulation of Solidification Structure and CET Process in High Silicon Steel Base on a CAFE Method	1183
<i>W. Song, J., Zhang, S. Wang, and B. Wang</i>	
The Research on the Dissolution Behavior of Carbonaceous Materials Used in COREX	1191
<i>H. Lin, J. Zhang, R. Xu, T. Song, H. Wang, and S. Liu</i>	

Amorphous Materials: Common Issues within Science and Technology

Mechanism of SiC Particles Controlling the Bubble Nucleation of Na ₂ O-CaO-SiO ₂ Porous Glass-Ceramics	1201
<i>J. Cao, Z. Wang, M. Yan, and J. Du</i>	

Corrosion and Oxidation of High Temperature Materials

Cyclic Fatigue Testing of a Ni-Based Alloy in a Corrosive Environment	1209
<i>D. Child, K. Perkins, H. Rosier, M. Dowd, J. Meldrum, and P. Onwuarolu</i>	
Effect of Increasing Cycle Frequency on the Oxidation Resistance of Ni-, Fe-, and Co-Based Alloys as 871, 982, and 1092°C	1225
<i>J. Meyer and B. North</i>	
Corrosion Assessment of High Temperature Alloys for SCWR Fuel Cladding Design	1233
<i>Y. Zeng, W. Zheng, B. Amirkhiz, M. Podlesny, and M. Matchim</i>	

Materials Characterization of the Oxidation and Combustion Behavior of Ti-6Al-4V X-Links from the Space Shuttle Columbia	1241
<i>J. Buckner, S. Stafford, and D. Cone</i>	
Investigation of Corrosion and Oxidation of γ -TiAl Alloys Obtained in Self Propagating High Temperature Synthesis	1249
<i>B. Sereda and D. Sereda</i>	
Investigation of the Microstructures and Oxidation Behavior of AlNiCoCrFe High-Entropy Alloys	1257
<i>T. Butler and M. Weaver</i>	

Data and Tools for Materials Discovery and Design

Materials Data Facility – Data Services to Advance Materials Science Research	1267
<i>B. Blaiszik, K. Chard, J. Pruyne, R. Ananthakrishnan, J. Towns, S. Tuecke, and I. Foster</i>	
Inverse Determination of Spatial Variation of Diffusion Coefficients in Arbitrary Objects Creating Desired Non-Isotropy of Field Variables	1275
<i>G. Dulikravich, S. Reddy, H. Orlande, and M. Colaço</i>	
Materials Data Curation: Introduction Proceedings	1283
<i>D. Saucedo, R. Arroyave, N. Chaudhary, I. Karaman, S. Youssef, A. Dima, R. Aramayo, and R. Perez</i>	
Multi-Objective Design and Optimization of Hard Magnetic Alloys Free of Rare Earths	1287
<i>R. Jha, G. Dulikravich, M. Colaço, I. Egorov, C. Poloni, N. Chakraborti, M. Fan, J. Schwartz, and C. Koch</i>	
Uncertainty in Materials Modeling, Simulation, and Development for ICME	1295
<i>Y. Wang</i>	
On Predicting Constitutive Equations for Use in Materials Design	1307
<i>C. Goh, A. Dachowicz, P. Collins, J. Allen, and F. Mistree</i>	

Deformation and Forming of Joined Materials

Friction Stir Spot Welding Parameters for Al6061 – An Experimental Design	1317
<i>M. Tashkandi</i>	
Fillet Weld Fatigue Strength by Changing Size and Dividing Weld to Three Parts	1327
<i>N. Tahanpesarandezfuly and J. Marzbanrad</i>	

Deformation and Transitions as Grain Boundaries IV

In-Situ Study of Deviation of $\Sigma 3$ Coincident Site Lattice Boundaries during Recrystallization of Cu-Zn Alloy	1345
<i>N. Sharma and S. Shekhar</i>	
Microstructure and Mechanical Properties of ARB Processed Mg-0.3%Gd Alloy	1355
<i>G. Wu and X. Huang</i>	

Energy Storage V: Materials, Systems and Applications Symposium

An Economical Approach to Run a Rail Road Locomotive Train by Using Hybrid Energy System	1367
<i>O. Butt</i>	
Review of Interstitial Metal Hydride Alloys Used in Contemporary Hydrogen Storage Application	1375
<i>E. Petersen, C. Trebilcock, E. Dawson, and P. Ferro</i>	

Preparations of Vanadium Substituted Lithium Iron Silicates for High Performance	1383
<i>X. Wei, C. Zhang, X. Cheng, Y. Zhang, and J. Huang</i>	

Failure Analysis and Prevention

High Temperature Drive Shaft Failure with a Twist	1393
<i>P. Taylor and H. Tian</i>	
Mechanical Properties and Microstructure of AISI41B30 Forgings in as Forged and Normalized Condition	1401
<i>D. Milicevic</i>	
Effects of Deformation Rate on Mechanical Behavior of AA 2024 Aluminum Alloy under Compressive Loading	1409
<i>A. Tihamiyu, A. Odeshi, and A. Badmos</i>	
High Rate Testing of NiTi Actuator Wire via Water Cooling	1419
<i>C. Lockwood and J. Schaffer</i>	
Understanding the Science behind Burst Resistant Exercise Balls and Why Some Burst during Use	1427
<i>D. Priddy</i>	
Unexpected Failures: Litigation Case Histories	1435
<i>F. Hossain and V. Ulčickas</i>	
Crack Assessment of Head Defect Repairs in Railroad Rail	1443
<i>W. Mohr, D. Workman, and J. Gould</i>	
Mechanism Analysis of Zinc Coating Peeling off in Galvanized Steel Sheet Forming	1455
<i>Y. Wang, Q. Zhang, and X. Peng</i>	
Fracture Surface Study of Powder Metal Parts	1463
<i>M. Darji</i>	

Glass and Optical Materials

Exploring the Structure of High Temperature Liquids with High Energy X-Rays	1473
<i>M. Wilding, C. Benmore, R. Weber, L. Skinner, O. Alderman, A. Tamalonis, and J. Parise</i>	
Perlite Foam Glass	1483
<i>B. Wang</i>	
Synthesis of New Derivatives of Rhodanine Dyes for Dye-Sensitized Solar Cells (DSSCs)	1489
<i>T. Boufares, M. Rahmouni, and S. Mir-Kasmi</i>	
Novel Approach to Crystal Derived Optical Fibers	1497
<i>M. Tuggle, C. Kucera, M. Jones, T. Hawkins, P. Dragic, and J. Ballato</i>	

Interfaces, Grain Boundaries, and Surfaces from Atomistic and Macroscopic Approaches

Evolution of Microstructure and Microtexture in a Cu/Ta Multilayer during Accumulative Roll-Bonding at High Temperature	1503
<i>T. Mungole, B. Mansoor, G. Ayoub, and D. Field</i>	
The Influence of Iodine Coverage on Grain-Boundary Yielding via Atomistic Simulation Using DFT and the Reactive Force Field	1511
<i>C. Taylor and M. Rossi</i>	

Effect of the Titanium Dioxide Content on the Interfacial Reactions between Titanium and Zirconia/Titanium Dioxide Composites	1519
<i>M. Lu and C. Lin</i>	
Reactive Phenomenon between Molten Titanium Alloy (Ti-6Al-4V) and $Y_2O_3/CaO/Al_2O_3$ Composites	1531
<i>C. Shen, C. Lin, and W. Huang</i>	
Reactive Phenomenon between Molten Titanium Alloy (Ti-6Al-4V) and $CaZrO_3/Y_2O_3$ Composites	1539
<i>Y. Peng, C. Lin, and S. Chang</i>	

Materials for Thermal Management of Electronic and Electrical Devices

A Comparative Study on the Thermal Conductivity of Aluminum Oxide-Reinforced Polymer Matrix Composites	1549
<i>H. Choi, A. Kim, M. Oh, and Y. Yoon</i>	

Materials Property Understanding through Characterization

An Alternative Crystallization Characterization Method for ZBLAN Glass	1559
<i>A. Torres and R. Barr</i>	
Evolution of CSL Boundaries in Nickel Alloy by Iterative and Non-Iterative Thermomechanical Processing	1567
<i>S. Sahu and S. Shekhar</i>	
Effect of Grain Orientation on Ageing Behaviour of Al-Mg-Si Alloy	1575
<i>S. Mishra, K. Kulkarni, and N. Gurao</i>	
Optimization of Hydrogen Embrittlement in Al-Zn-Mg Alloys	1583
<i>K. Shimizu, H. Toda, K. Sasaki, K. Uesugi, and A. Takeuchi</i>	
Growth Behavior of Hydrogen Micro Pores in Al-Zn-Mg-Cu Alloys during High Temperature Exposure	1589
<i>H. Su, H. Toda, K. Uesugi, A. Takeuchi, and Y. Suzuki</i>	
Crystallization and Thermal Characteristics of Poly Lactide-Natural Fibre Composites	1595
<i>E. Akpan, S. Adeosun, G. Lawal, S. Balogun, and X. Chen</i>	
A Novel Method of Modeling of Fundamental Properties of Materials	1605
<i>V. Ginzburg</i>	

Materials Science of Additive Manufacturing

Cloud-Based Manufacturing Process Simulation Program	1615
<i>J. Evans, E. Moore, J. Shelton, and C. Skira</i>	
Optimization of Processing Parameters for Additive Manufacturing by Analytical Layerwise Model	1625
<i>J. Cheng</i>	
Performance Prediction and Risk Assessment for Additive Manufacturing via Bayesian Network Analysis	1633
<i>C. Taylor, S. Guan, and L. Cao</i>	
Development and Optimization for Metallic Parts/Components Using Powder Bed Additive Manufacturing	1641
<i>Y. Zhou, S. Siw, C. Schade, M. Chyu, and C. Garcia</i>	
Microstructural Quantification of Rapidly Solidified D2 Tool Steel	1653
<i>J. Valloton, P. Khatibi, D. Herlach, and H. Henein</i>	

Scandium Effects on Nucleation Undercooling in Al-Cu Droplets Generated by Impulse Atomization and Electro-Magnetic Levitation	1661
<i>A. Bogno, J. Valloton, P. Natzke, S. Yin, D. Herlach, and H. Henein</i>	
Investigation of 3D Printing Parameters of Shape Memory Alloy Powders	1669
<i>M. Caputo, M. Krizner, and C. Solomon</i>	
Study on Thermal Distortion of Cast Iron Cooling Stave with Elliptic Water Pipes	1677
<i>G. Guo, J. Zhang, and F. Li</i>	

Multifunctional Oxides

Thickness Dependent Photoelectric Responses of ZnO Nanoparticle Films	1687
<i>Q. Zhu and C. Xie</i>	

Novel Material and Process Development for Additive Manufacturing

Scanning Laser Epitaxy – A Novel Metal Additive Manufacturing Process Developed for Gas Turbine Hot-Section Alloys	1697
<i>A. Basak, R. Acharya, R. Bansal, and S. Das</i>	

Pb-free Solders and Advanced Interconnecting Materials

Micro Hardness of MWCNT Reinforced 70Sn–30Bi Solder Alloys	1707
<i>M. Billah and Q. Chen</i>	
The Effects of Substitution of Bi for Sn on the Soldering Properties of near Eutectic Sn-Ag-Cu Soldering Alloys	1715
<i>A. Olofinjana, N. Voo, and M. Matahir</i>	
Effect of Minor Mn Addition on the Microstructure and Corrosion Behavior of Sn–Zn Lead-Free Solder Alloy	1725
<i>J. Liu, G. Zhang, J. Ma, Q. Shi, and K. Suganuma</i>	
High Reliability Green Alloys for High Temperature Operating Conditions	1733
<i>P. Choudhury, M. de Avila Ribas, A. Kumar, S. Mukherjee, S. Sarkar, R. Pandher, and B. Singh</i>	
Effect of Ga on the Inoxidizability and Wettability of Sn-0.5Ag-0.7Cu-xGa Solder	1741
<i>X. Songbai, L. Dongxue, X. Peng, X. Jiachen, and W. Jianxin</i>	

Surface Properties of Biomaterials

Cellular and Acellular Characterization of β -Tricalcium Phosphate Porous Scaffolds Reinforced with Phosphate-Based Bioglass for Bone Tissue Engineering	1753
<i>C. Ruiz-Aguilar, E. Aguilar-Reyes, A. Higareda-Mendoza, and C. León-Patiño</i>	
15 Years of Making Better Biomaterials: One Nano-Step at a Time	1761
<i>S. Chung, M. Stolzoff, J. Bilsback, B. Ercan, and T. Webster</i>	
In Vitro Evaluation of Calcium Phosphate Coatings on Ti6Al4V Substrates	1769
<i>E. Aguilar-Reyes, B. Jacinto-Díaz, C. León-Patiño, and A. Higareda-Mendoza</i>	

Ultra High Performance Metals, Metal Alloys, Intermetallics, and Metal Matrix Composites for Aerospace and Defense Applications

Microstructures and Mechanical Properties in Al-Cu-CNFs Metal Matrix Composite Processed by CGG and Spray Forming Process	1779
<i>Y. Yang</i>	
Phase Formation and Growth Kinetics in Al-Stainless Steel Metallic-Intermetallic Laminate (MIL) Composites	1789
<i>Y. Wang and K. Vecchio</i>	
Ultra-High Strength Composite Materials Developed by Mechanonanosynthesis Processing	1797
<i>E. Laitila and D. Mikkola</i>	
Preliminary Evaluations in the Welding of Bulk Metallic Glasses	1805
<i>J. Gould</i>	
Effect of Thermal Deformation on Forging Bar Microstructure and Properties of Inconel 718 Alloy	1815
<i>Y. Zhang, Q. Wang, J. Wu, G. Chen, Z. Wang, and P. Dai</i>	

Author Index

Subject Index