

Materials Science & Technology Conference and Exhibition 2016 (MS&T'16)

**Salt Lake City, Utah, USA
23 – 27 October 2016**

Volume 1 of 2

ISBN: 978-1-5108-3314-2

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© (2016) by Materials Science & Technology (MS&T)
All rights reserved.

Printed by Curran Associates, Inc. (2017)

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: +1.724.814.3000
Fax: +1.724.814.3001

memberservices@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: 845-758-2633
Email: curran@proceedings.com
Web: www.proceedings.com

TABLE OF CONTENTS

Contributed Papers from Materials Science & Technology 2016 (MS&T16)

Edited Manuscripts

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

Characterization of Selective Laser Melted 304L	5
<i>Wes Everhart, Paul Korinko, Marissa Reigel, Michael Morgan, and John Bobbitt</i>	
Investigation of the Solidification Effects of Microstructures of Laser Melted Stainless Steel	13
<i>E.F. Özel, H. Mozaffari-Jovein, and C. Müller</i>	
The Effect of Beam Spot Size on Melt Pool Geometry in Direct Metal Additive Manufacturing Processes	25
<i>Zachary Francis and Jack Beuth</i>	
Effect of Hot Isostatic Pressing on Mechanical Properties and Dimensional Accuracy of Intentionally Porous Ti6Al4V Parts Made by Selective Laser Melting	35
<i>Raya Mertens, Bart Boeckmans, Lore Thijss, Jan Van Humbeeck, and Jean-Pierre Kruth</i>	
Analysis of Residual Stress Formation in Additive Manufacturing of Ti-6Al-4V	43
<i>Mauritz Möller, Dirk Herzog, Tim Wischeropp, Claus Emmelmann, Christina Krywka, Peter Staron, and Maximilian Munsch</i>	
Carbide Formation in Additive Manufacturing of Single-Crystal Superalloy René N5 Processed through Scanning Laser Epitaxy	51
<i>Amrita Basak and Suman Das</i>	
Effect of Heat Treatment on the Microstructures of MAR-M247 Fabricated through Scanning Laser Epitaxy	59
<i>Amrita Basak and Suman Das</i>	
Microstructure, Tensile Properties, and Fatigue Crack Growth Behavior in Inconel 718 Manufactured by Laser Engineered Net Shaping	67
<i>Yuwei Zhai and Diana Lados</i>	
Damage Development in Thin Walled Selective Laser Melted Structures	79
<i>Jonas Saarimäki, Johan Moverare, and Håkan Brodin</i>	
Reliability Estimation of Additive Manufacturing Process Parameters Using Surrogate Modeling	87
<i>Azadeh Keshtgar, Kai Wing Kelvin Leung, and Nagaraja Iyyer</i>	
A Partial Solution to Modeling the Anisotropic Material Properties of Fused Deposition Modeling ABS – Part 1 of 2	95
<i>Ross M. Fischer, Keenan G. Jewkes, and Scott Kessler</i>	
Microstructural Characterization of As-Manufactured and Heat Treated Electron Beam Melted Inconel 718	105
<i>Dunyong Deng, Jonas Saarimäki, Hans Söderberg, Ru Lin Peng, Håkan Brodin, and Johan Moverare</i>	
<u>Additive Manufacturing: In-Situ Process Monitoring, Defect Detection and Control</u>	
In Situ Monitoring of Directed Energy Deposition	115
<i>C.M. Knapp, T.J. Lienert, J.S. Carpenter, and D. Kovar</i>	

3D Analysis in Laser Beam Melting Based on Real-Time Process Monitoring	123
<i>Thomas Toeppel, Philipp Schumann, Marie-Christin Ebert, Tobias Bokkes, Kerstin Funke, Michael Werner, Fabian Zeulner, Florian Bechmann, and Frank Herzog</i>	
On the Requirements for Model-Based Thermal Control of Melt Pool Geometry in Laser Powder Bed Fusion Additive Manufacturing	133
<i>Jason Fox, Felipe Lopez, Brandon Lane, Ho Yeung, and Steven Grantham</i>	
Identification of Sub-Surface Defects in Parts Produced by Additive Manufacturing, Using Laser Generated Ultrasound	141
<i>Sarah K. Everton, Phill Dickens, Chris Tuck, and Ben Dutton</i>	
Monitoring of Humidity in Laser Based Powder Bed Fusion Systems	149
<i>Simon Jahn, Stefan Szemkus, and Robert Kahlenberg</i>	

Advanced Coatings for Wear and Corrosion Protection

Parameters Control of 09Cr3NiMo3VNbr Carburizing Steel Diffusion Layer in the Process of Thermochemical Treatment	159
<i>V. Mishchenko, O. Menialo, O. Bagriichuk, and O. Bulakh</i>	
Laser Heating of NiCr-Al ₂ O ₃ Composite Coating Made on Low Carbon Steel by Twin Gun Thermal Spray Process	167
<i>Manoj Rathod, Rohit Bardapurkar, and Shubham Mohod</i>	
Multilayer Ceramic Coating for Corrosion (C3) Resistance of Nuclear Fuel Cladding	175
<i>E. Alat, A.T. Motta, R.J. Comstock, J.M. Partezana, and D.E. Wolfe</i>	
Application Temperature Control Smooths Coating to Improve Corrosion Resistance	183
<i>Michael R. Bonner</i>	
REACH Compliant Functional Trivalent Chromium Electroplating	195
<i>Timothy D. Hall, Stephen T. Snyder, Maria Inman, and E.J. Taylor</i>	
Electrochemical and Performance Testing of Nano Engineered-Coatings Based on ANA Presence when Exposed to Corrosive Environment	203
<i>Tse-Ming Chiu, Emily M. Hunt, Benton Allen, and H. Castaneda</i>	

Advanced Materials for Oil and Gas Applications - Performance and Degradation

Hydrogen Induced Stress Cracking of Duplex Stainless Steel under Cathodic Protection in Seawater – Historical Overview and Lessons Learned	213
<i>Roy Johnsen</i>	
Hydrogen Induced Cracking in X70 Pipeline Steels	225
<i>M.K. O'Brien, K.O. Findley, and J.G. Speer</i>	
AF955 (UNS N09955): A New Ni-Base Alloy for Oil and Gas Applications	235
<i>Luca Foroni, Stanley Gregory, Tom Grubach, and Carlo Malara</i>	

Heterogeneity during Plastic Deformation – Synergy between Experimental Investigation and Simulation

Designing Heterogeneous Nano-Microstructures to Improve Mechanical Properties	245
<i>Mehdi Hamid, Hao Lyu, Annie Ruimi, and Hussein M. Zbib</i>	

Light Metal Technology

Numerical Simulation and Experimental Validation of Hydroforming of Square Cups Using Cryorolled Aluminum Alloy Sheets	255
<i>Fitsum Taye and D. Ravi Kumar</i>	
Influence of Zirconium on the Growth of Al ₃ Ti and TiB ₂ Particles in Aluminum Alloys	263
<i>Haibin Ma, Xingtao Liu, and Xiaoming Wang</i>	
Investigation of the Thermal Stability during Thermal Exposure of A201, 319S and 2618 Alloys	271
<i>Junzhen Gao, Qiang Zhu, Daquan Li, and Yonglin Kang</i>	
Recrystallization Behavior and Texture Evolution during Hot Deformation of Extruded ZK60 Magnesium Alloy	281
<i>Amir Hadadzadeh, Sugrib Kumar Shaha, Mary A. Wells, Hamid Jahed, and Bruce W. Williams</i>	
Sliding Wear Characteristics of Sintered Ti6Al4V Alloy as a Function of Holding Time	289
<i>Adewale Oladapo Adegbenjo, Elsie Nsiah-Baafi, Mxolisi Brendon Shongwe, Mercy Ramakokovhu, Peter Apata Olubambi, and Johannes Herman Potgieter</i>	
Hot Deformation Behavior of a High-Temperature Titanium Alloy with Initial Thick Lamellar Microstructure	297
<i>Hui Li, Zhanglong Zhao, Hongzhen Guo, Tianhong Mao, and Peng Zhang</i>	

Materials Tribology

High Temperature Solid Particle Erosion of Thermal Spray Barrier Coatings	307
<i>Anderson G.M. Pukasiewicz, Wellington Uczak de Goes, André Chicoski, Frederico Hackbart, Newton Reis de Moura, and Paulo Sérgio Brito de Souza</i>	

Modeling of Multi-Scale Phenomena in Materials Processing and Advanced Manufacturing

Thermal and Flow Behavior of Melt Pool during Selective Laser Melting of AlSi10Mg Powder in Point Exposure Laser Scan Pattern	317
<i>Pingmei Tang, Xueping Ding, Dengfu Chen, Sheng Yu, Xuanming Duan, Mujun Long, and Huamei Duan</i>	
Secondary Steelmaking CAS-OB Process Kinetic Model	325
<i>Fuzhong Ji, Andrew M. Smith, Alun H. Thomas, Zushu Li, and Wouter Tiekkink</i>	
Numerical Simulation of Inclusion Aggregation and Removal in a Bottom Gas-Injected Ladle during Molten Steel Deoxidation	335
<i>Yanbin Yin, Jiongming Zhang, Shaowu Lei, Shunxi Wang, and Qipeng Dong</i>	
Stochastic Modeling for Prediction of the Columnar to Equiaxed Transition during Solidification of Magnesium-Based Alloys	345
<i>Ahmad Salman and Laurentiu Nastac</i>	
The Method for Determination of the Influence of the Stress-Strain State of Metal on the Structural Transformations in the Low-Alloy Steel	353
<i>Sergey Shejko, Serhii Yechyn, and Nikita Demchenko</i>	
Thermal Non-Equilibrium Effects on Nickel Solid-Liquid Interface	359
<i>Nicholas Brown, Enrique Martinez, and Jianmin Qu</i>	

Multi Scale Modeling of Microstructure Deformation in Material Processing

Modeling the ViscoPlastic Behavior of Commercial Aluminum Alloys as a Function of Recrystallized Grain Fractions and Texture	369
<i>Khaled F.M. Adam and David P. Field</i>	
Modeling of Material Processing and Microstructure of Long Product	377
<i>Michael Kruse</i>	
A Molecular Dynamics Study of Defects Produced by Displacement Cascades in bcc-Fe	385
<i>Maosheng Li, Chan Gao, and Hua Liang</i>	

Shaping and Forming of Composite Materials

Development of In-Situ Monitoring Systems for the Thermoforming of Pre-Preg Composite Laminates	393
<i>P. Land, D.T. Branson, R. Crossley, and S. Ratchev</i>	
Microstructure and Mechanical Properties of Ti/AZ31 Multi-Layered Materials Processed by Accumulative Roll Bonding	401
<i>C.S. Hsu, N. Zou, and Q.Z. Li</i>	

Unedited Manuscripts

Advanced High Strength Steel Design / Technological Exploitation

Ultra-Fine-Grained Quenching and Partitioning (Q&P) Steel Produced by Near A_{c3} Austenitizing	413
<i>Eun Jung Seo, Lawrence Cho, and Bruno C. De Cooman</i>	
Work Hardening Behavior in Medium Mn TRIP Steels	421
<i>Michael Callahan and Jean-Hubert Schmitt</i>	
Annealing Temperature Dependence of the Tensile Behavior of 6Pt Mn Multi-Phase TWIP-TRIP Steel	429
<i>Seonjong Lee, Sunmi Shin, Minhyeok Kwon, and Bruno C. De Cooman</i>	
Dynamic and Static Recrystallization of V Micro-Alloyed TWIP Steel	439
<i>Hojun Gwon, Sunmi Shin, and Bruno C. De Cooman</i>	
Composition and Property Designing of TRIP and TWIP Steels	447
<i>Lin Li, Hu Jiang, Tingdong Ren, Yanlin He, Wen Shi, and Mei Zhang</i>	
Research on Galvanisability of High Manganese Alloyed Steel Containing Vanadium	459
<i>Tingdong Ren, Hu Jiang, Nan Zou, and Wen Shi</i>	
The Effect of MA Dispersed Morphology on Ductile Fracture Behavior in Bainite-MA Dual Phase Steels	467
<i>Junji Shimamura and Shunsuke Toyoda</i>	
Hydrogen Embrittlement of Ultra-High Strength PHS and TWIP Steel Grades	473
<i>Lawrence Cho, Dimas Hand Sulistiyo, Eun Jung Seo, Kyoung Rae Cho, and Bruno C. De Cooman</i>	
DMAIC of Structural Steel Parts through FEM and DOE	481
<i>Roberto Gonzalez, Maria Jose Quintana, and Luis Felipe Verdeja</i>	
Influence of Composition and Processing on the Strength and Torsional Ductility of High Strength Steel Wire	491
<i>C.M. Ciganik, J.G. Speer, K.O. Findley, and W. Van Raemdonck</i>	

Precipitation Strengthening by Induction Treatment in High Strength Low Carbon Microalloyed Hot Rolled Plates	499
<i>G. Larzabal, N. Isasti, B. Pereda, J.M. Rodriguez-Ibane, and P. Uranga</i>	
Validation of an Indirect Technique to Quantify the Amount of Niobium in Solution Prior to Hot Rolling	509
<i>G. Larzabal, L. Garcia-Sesma, B. Pereda, P. Uranga, M. Rebellato, B. López, and J.M. Rodriguez-Ibane</i>	
Effect of Induction Hardening Case Depth on Residual Stresses, Microstructural Phases and Fatigue Strength of 38MnVS6 Micro Alloyed Steel	517
<i>Dattaprasad Lomate, Asim Tewari, P.P. Date, Manoj Ukhade, Girish Shegavi, and Rajkumar Singh</i>	
A Study on the Viscous Behaviour with K ₂ O Additions on the Slags	525
<i>Junqiang Yang, Jianliang Zhang, and Cui Wang</i>	
Effect of Magnesium Addition on Inclusion Size Distribution in OCTG Steel	533
<i>Linzhu Wang, Jingshe Li, Shufeng Yang, Shuo Zhang, and Yang Wang</i>	
Effect of B ₂ O ₃ on the Viscosity and Structure of the Aluminate-Based Melts	541
<i>Chengjun Liu, Jie Qi, and Maofa Jiang</i>	
Effect of Iron on Combustion Characteristics of Coal Char Pyrolyzed by Lump Coal	547
<i>Haiyang Wang, Jian-liang Zhang, Guang-wei Wang, Run-sheng Xu, Si-yuan Liu, Teng-fei Song, and Ke Guo</i>	
Application of the EAF Steelmaking Combined Blowing Technology in 100T EAF	555
<i>Guohong Ma, Lingzhi Yang, Rong Zhu, Zhizheng Li, Xueyi Wang, Guangsheng Wei, and Ting Cheng</i>	
Determination of Surface Tension of Commercial Steels and Mould Fluxes by Sessile Drop Method	565
<i>Qiang Gao, Jian Luo, Yi Min, and Maofa Jiang</i>	
Effect of Cementite on Ductile Fracture in High Tensile Strength Steel Sheets	573
<i>Mari Maeda, Junji Shimamura, and Shinsuke Suzuki</i>	
Investigation of Combustion Reaction Kinetic of Anthracite by Sectioning Method	579
<i>Ruiling Du, Keng Wu, Li Zhang, Xuanke Qin, and Bing Zhang</i>	
Research on the Generation Characteristics and Particle Size Distribution of Steelmaking Dust	587
<i>Zhizheng Li, Rong Zhu, Guohong Ma, Xueliang Wang, and Yiqiang Zhu</i>	
Study on Chlorine Distribution between Bosh Gas and Slag in Blast Furnace	597
<i>Cui Wang, Jian-Liang Zhang, He-Shun Zhang, Zheng-Jian Liu, and Ke-Xin Jiao</i>	
The Effect of Sodium and Zinc on Metallurgy Character of Sinter Ore in BF	609
<i>Zhiwu Yan, Jianliang Zhang, Zhengjian Liu, Xiang Yuan, Bin Gao, and Heshun Zhang</i>	

Advanced Manufacturing Technologies

Finite Element Analysis and Simulation of the Manufacturing Process of Hot Formed Vessel Heads	619
<i>Fátima Méndez-Medina, Roberto G. Ramírez-Galindo, Ricardo Araiza-González, and Miguel A. Quiñones-Salinas</i>	
Numerical Simulation and Experimental Validation of Hydroforming of Square Cups Using Cryorolled Aluminum Alloy Sheets.....	629
<i>Fitsum Taye and D. Ravi Kumar</i>	
Rapid Heat Treatment Process Using Microwaves – A Novel Approach	637
<i>Swaminathan G, Prasanna Venkatesh P R, and Rajendra Prasad A</i>	

The Profile Correction Module: A Whole New Approach to Coil Coating	645
<i>Michael R. Bonner</i>	
Research on the Cutting Thermodynamic Behavior of High-Strength Large-Thickness Offshore Jack-Up Platform Leg Rack	655
<i>Zhou Hong</i>	
Diffusion Bonding in Advanced Manufacturing Process Chains	665
<i>Simon Jahn, Felix Gemse, Steffen Dahms, Udo Broich, and Jan Pfeifer</i>	
Wear and Hardness Properties of Surface Modification of Copper Alloy Processed by Friction Stir Process	673
<i>Kazeem O. Sanusi and Esther T. Akinlabi</i>	
Magnetic Field Assisted Assembly Machine Design & Implementation	679
<i>Yan Liu and Nuggehalli M. Ravindra</i>	
The Novel Use of Acoustic Emission Monitoring during Proof-Testing of Ceramic Spinal Implants	687
<i>Darin A. Ray, Ramaswamy Lakshminarayanan, Bryan J. McEntire, and Obdulia Ley</i>	
Numerical Analysis of Raceway Combustion under Different Operating Conditions in a Blast Furnace	705
<i>Haibo Ma, Tyamo Okosun, Armin K. Silaen, Bin Wu, Guangwu Tang, and Chenn Q. Zhou</i>	
Repair Processes for Forging Dies and Their Testing and Impact	713
<i>Pavel Podany and Michal Duchek</i>	
Microstructure and Mechanical Properties of the As-Cast and Extruded Al-Si-Fe-Cu-Mn Based Alloys Fabricated by Adding Grain Refiner	721
<i>Hyeon-Taek Son, Yong-Ho Kim, Hyo-Sang Yu, and Jung-Han Kim</i>	
Optimization of Filler Materials for Large Forging Dies	727
<i>Michal Duchek, Martina Koukolikova, Jana Niznanska, and Miroslav Majer</i>	

Advances in Metal Casting Technologies

Influence of Water Quality on Rate of Quenching of Metals during Continuous Casting by Pneumatic and Hydraulic Sprays	735
<i>Umair Alam and Eckehard Specht</i>	
Comparison of Conventional Open-Cell Aluminum Foam and Its Additively Manufactured Twin	745
<i>Kristoffer Matheson, Kory Cross, Iman Javahery, Jayden Plumb, and Ashley Spear</i>	
Flow Field Research on Bottom Argon Blowing of 40-Ton Ladle	753
<i>Tongjun Zhou, Junzhan Liu, and Hui Luo</i>	
Study on Vertical Continuous Casting of M2 High Speed Steel	761
<i>Zhigang Zhao, Shengtao Qiu, and Rong Zhu</i>	
Development of Medium-High Carbon Casing/Tubing for Direct Strip Production Complex (DSPC)	769
<i>Tihe Zhou, Peng Zhang, Kate Kuuskman, Erminio Cerilli, Kashif Rehman, Sang-Hyun Cho, and Dan Burella</i>	
Influence of Secondary Cooling Intensity Variation on Solidification Structure and Carbon Macro-Segregation for GCr15 Continuously-Cast Bloom	777
<i>Kun Dou, Zhenguo Yang, Qing Liu, Jung-Wook Cho, and Hongbiao Dong</i>	
Uneven Thermal Shrinkage of Wide-Thick Continuous Casting Slab and Its Influence on Caster Taper	785
<i>Chen-hui Wu, Cheng Ji, and Miao-yong Zhu</i>	

Industrial Trial Practice of Slab Corners Microstructure Control	793
<i>Jingxin Song, Zhaozhen Cai, Miao Yong Zhu, and Nailiang Cheng</i>	

Advances in Zinc-Coated Sheet Steel Processing and Properties

Surface Selective Oxide Reduction during Continuous Annealing of Advanced High Strength and Ultra-High Strength Steel Grades	801
<i>Lawrence Cho, Jong Han Oh, Eun Jung Seo, Myung Soo Kim, Ki Cheol Kang, and Bruno C. De Cooman</i>	
Evolution of Zn-Rich Phases during Austenitizing of Galvanized 22MnB5 Sheet Steel	807
<i>Z.N. Ghanbari and J.G. Speer</i>	
Effect of Coating Thickness and Mg Content on Adhesion Strength and Corrosion Behavior of EML-PVD Alloy Coating on Steel Strip	815
<i>Woo Sung Jung, Chan Wook Lee, and Bruno C. De Cooman</i>	

Corrosion Resistance and Mechanical Properties Zinc Coating Sheet Steels, Received in Conditions of Self-Propagating High Temperature Synthesis	825
<i>Borys Sereda and Dmytro Sereda</i>	

Art and Cultural Heritage: Discoveries and Education

STEAM Initiatives at the Carlos Museum: Bringing Science into the Galleries and Cultural Heritage into the Classroom	833
<i>Renée Stein, Kathryn Etre, Emily Farek, and Julia Commander</i>	

Fracture on Marble-Adhesive Interfaces of Restored Art Structures	839
<i>Ting Tan, Nima Rahbar, Carolyn Riccardelli, George Wheeler, and Wole Soboyejo</i>	

Characterization of Native Copper Refining through Optical Metallography of the Copper Oxide Phase	847
<i>Megan Godby, Karl Rundman, and Paul Sanders</i>	

Thermal Spray in Art & Architecture	855
<i>Peter Foy, Matt Napolitano, and Dale Moody</i>	

Non-Destructive Methods Using in Paintings on Traditional Temple Heritage in Taiwan	861
<i>Chen-Fu Wang, Lin-Ya Kung, Chih-Ming Chou, and Chun-Yu Chen</i>	

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

Development of Wear Resistant WC Metal Matrix Composites Consolidated via Laser-Assisted Cold Spray	871
<i>A.M. Birt, J. Dallarosa, and D. Apelian</i>	

Microstructure and Mechanical Properties of Carbonized Rice Husk Nanoparticles Reinforced Al-Cu-Mg Alloy Composite	883
<i>S.B. Hassan, J.O. Agunsoye, and V.S. Aigbodion</i>	

Properties of Microwave Sintered Al-Cu Metal Matrix Composites	891
<i>M. Penchal Reddy, F. Ubaid, R.A. Shakoor, and A.M.A. Mohamed</i>	

Sliding Friction Behavior of Aluminum Based Hybrid Composites	899
<i>Tahir Ahmad, Maida Bashir, Muhammad Kamran, Rafiq Ahmad, and Muhammad Umar Manzoor</i>	

Bilayer Graded Al/SiC/Rice Husk Ash Composite: Thermal and Electrical Properties	907
<i>A. Bahrami, M.I. Pech-Canul, S. Soltani, N. Soltani, C.A. Gutierrez, and Luis. A. Gonzalez</i>	

Porous Silicon Oycarbide Composites with Aligned Macro Porosity from Water-Based Slurry by Freeze-Casting Process	915
<i>N. Soltani, U. Simon, A. Bahrami, S. Zavareh, O. Görke, M.I. Pech-Canul, and A. Gurlo</i>	

Thermal and Electrical Properties of Infiltrated High Volume Fraction Si_3N_4 and Si_3N_4 -Coated SiO_2 Preforms by Al-Mg-Si Alloys as Heat Sink Materials in Electronic Packaging	921
<i>N. Soltani, M.I. Pech-Canul, S. Soltani, A. Bahrami, and L.A. Gonzalez</i>	

Boron, Boron Coatings, Boron Compounds and Boron Nanomaterials: Structure, Properties, Processing, and Applications

Development of Protective Coatings Formulations Based on Boron for Units Operating at High Temperatures in Metallurgy	931
<i>Borys Sereda and Dmytro Sereda</i>	

Nano-Mechanical Behaviour and Microstructure of Boride Layers Formed on Inconel 718 before and after Aging	935
<i>A. Khalili, M. Yari, and R.J. Klassen</i>	

Obtaining of Boride Coatings under SHS Conditions for Car Parts	945
<i>Borys Sereda and Dmytro Sereda</i>	

Emerging Interconnect and Pb-Free Materials for Advanced Packaging Technology

Fabrication of Cu@Sn Core-Shell Structure Preform and Application in High Temperature Bonding	951
<i>Tianqi Hu and Hongtao Chen</i>	

Compound Growth during Reaction Diffusion between Liquid Sn-Base Alloys and Solid Fe	957
<i>Ryo Fukui, Minho O, and Masanori Kajihara</i>	

Kinetics of Reactive Diffusion between Sn-Ag Alloys and Ni at Solid-State Temperatures	961
<i>Misako Nakayama, Minho O, and Masanori Kajihara</i>	

Failure Analysis and Prevention

Extremely Low Cycle Fatigue Damage Mechanism, Fractographic Examination, and Life Prediction	967
<i>Mohammed Algarni and Yuanli Bai</i>	

Inclusion Orientation Effect on Rolling Contact Fatigue Crack Paths Observed by Laminography Using Synchrotron Radiation X-Ray	975
<i>Y. Nakai, D. Shiozawa, S. Kikuchi, T. Obama, H. Saito, T. Makino, and Y. Neishi</i>	

The Challenges of Coiled Tubing Failure Analyses	983
<i>Michael G. Burns, Kevin Elliott, Pankaj Kumar, Travis Graham-Wright, and Austin Sutch</i>	

Failure Analysis of Bolted Joints at Elevated Operating Temperatures in Gas Turbine: A Case Study of Creep of the Washers and Cracking of the Bolts	993
<i>Derek Dangguo Gong and Paul Flynn</i>	

Actuator Spring Failures in the Oil & Gas Industry	1001
<i>Richard Marques, Herman E. Amaya, and Christian Silva</i>	

Study of the Stainless Steel Corrosion in Pharmaceutical Facilities: Development and Incidence	1009
<i>Fabienne Delaunois, François Tosar, and Frédéric Groulard</i>	

Scanning Electron Microscopy/Energy Dispersive X-Ray Spectrometry (SEM/EDS) Elemental Microanalysis: Accuracy and Precision beyond My Wildest Dreams	1017
<i>Dale E. Newbury and Nicholas W.M. Ritchie</i>	

SEM/EDS Elemental Microanalysis Can Be Remarkably Quantitative, but Easy to Break: Cautions in Using Analytical Software	1025
<i>Dale E. Newbury and Nicholas W.M. Ritchie</i>	

Gas/Metal Reactions, Diffusion and Phase Transformation during Heat Treatment of Steel

The Effect of Hardenability on Deformation of Spiral Bevel Gear in Die Quenching Process	1033
<i>Yingtao Zhang, Gang Wang, Lin Yang, Wankai Shi, and Zhichao (Charlie) Li</i>	

Effect of Tempering Temperature on the Microstructure, Mechanical and Magnetic Properties of 26NiCrMoV11-5 Steel	1043
<i>Santosh Mane, N. Prabhu, Sagar Bapat, and R.K.P. Singh</i>	

Increased Strength Multi-Phase Steels as a Result of Heat Treatment of Automobile Wheels	1055
<i>Borys Sereda and Dmytro Sereda</i>	

A Study of Fishscale Resistance in Boron Microalloyed Low Carbon Al-Killed Enameling Steel Compact Strip Production (CSP) Steel Mill	1061
<i>Ranga Nikhil Yellakara</i>	

Multi-Phase Numerical Research on Oxygen Lance Blowing High Temperature Oxygen	1069
<i>Shaoyan Hu, Rong Zhu, and Fuhai Liu</i>	

ICME Accelerated Materials Discovery in Process & Product Development

ICME Investigation of Electrical Conductivity of Al-Zn-Ni Alloys for Precipitation Hardening	1079
<i>Oladeji Fadayomi, Rachel Clarke, Violet Thole, Gregory Odegard, and Paul Sanders</i>	

Joining of Advanced and Specialty Materials (JASM XVIII)

Weldability of Titanium Alloy Using Transient Liquid Phase Diffusion Bonding Method	1089
<i>A.H.M.E. Rahman and Issam Abu-Mahfouz</i>	

To Design of Welding Procedure to Avoid Delayed Cracking Phenomenon in ASTM A335 P22 Material	1097
<i>Fahad Riaz, Muhammad Kamran, Adil Ashraf, Nauman Aslam, and Tahir Ahmad</i>	

Room Temperature Molecular Dynamics Simulations on the Sintering of Cu-Ag Core-Shell Structures: Nanoparticles and Nanowires	1103
<i>Jiaqi Wang and Seungha Shin</i>	

Fatigue Behaviour of AL6XN Super-Austenitic Stainless Steel Welds	1111
<i>I.S. Cortés-Cervantes, V.H. López-Morelos, Y. Miyashita, C.A. León, and A. Ruiz</i>	

Materials Property Understanding through Characterization

p-Silicon Based Microbolometer	1121
<i>Asahel Banobre and N.M. Ravindra</i>	

Characterization of Porous Structure of Graphitic Cathode Materials with Different Graphitization Degree and Its Correlation to Air Permeability	1133
<i>Xiang Li, Shihao Song, Jilai Xue, and Ning Fang</i>	
Optical Properties of Passivation Layers on Black Silicon	1141
<i>Sita Rajyalaxmi Marthi and N M Ravindra</i>	
Optical Properties and Temperature Dependence of Energy Gap of Transition-Metal Dichalcogenides	1153
<i>Sushant S. Rassay, Weitao Tang, and Nuggehalli M. Ravindra</i>	
Microstructural Characterization of Sub-Surface Deformation in Machined Ti-6Al-4V under Varying Cutting Fluid Application	1165
<i>Nithin Rangasamy and A.K. Balaji</i>	
Effect of Cryogenic Quenching on Microstructure and Microhardness of Rapidly Solidified Grey Cast Iron	1173
<i>Olamilekan Oloyede, Robert F. Cochrane, and Andrew M. Mullis</i>	
Study of Fatigue Crack Growth Analysis in Microalloyed Steel (38MnVS6) Using Digital Image Correlation	1179
<i>A.B. Patil, K.N. Jonnalagadda, and S.P.Toppo</i>	
Influence of Quenching Processes on Microstructure and Mechanical Properties of 800MPa High Strength Steels	1187
<i>Zhengtao Duan and Xinhua Pei</i>	
Behaviour of Asphalt Concrete beyond Its Limit of Elasticity	1195
<i>Lee Leon, Raymond Charles, and Nicola Simpson</i>	

Perspectives for Emerging Materials Professionals

Capitalizing on Success: How to Reclaim the Direction of Your Education and Career at the Undergraduate Level	1205
<i>Emily E. Petersen</i>	

Phase Stability, Diffusion Kinetics, and Their Applications (PSDK-XI)

Numerical Approach to Obtaining Thermal Degradation Kinetics for 3D Compact Binder Removal	1215
<i>J.L. Prati, M.J. Matthewson, and R.A. Haber</i>	
Non-Isothermal Nanocrystallization Kinetics of FINEMET Type Alloys Using a Direct Extension of JMAK Theory	1223
<i>Alejandro F. Manchón-Gordón, Javier S. Blázquez, Clara F. Conde, and Alejandro Conde</i>	

Phase Transformations in Ceramics: Science and Applications

Patterning Oxide Nanopillars at the Atomic Scale by Phase Transformation	1233
<i>Chunlin Chen, Frank Lichtenberg, Yuichi Ikuhara, and Johannes Georg Bednorz</i>	

Solid State Processing

The Influence of Deformation Twinning on Copper 220 Caused by Cryogenic Processing	1241
<i>Janette D. Fernelius, Eric R. Homer, and Tracy W. Nelson</i>	

Surface Protection for Enhanced Materials Performance: Science, Technology, and Application

Effect of Processing Parameters on APS and HVOF Flashcoat Deposition of TBC Coatings	1251
<i>Anderson G.M. Pukasiewicz, Wellington Uczak de Goes, Irene Bida de Araújo, Gustavo Bavaresco Sucharski, Frederico Hackbart, Newton Reis de Moura, and Paulo Sérgio Brito de Souza</i>	
Influence of the Deposition Parameters on Characteristics of Electrodeposited Zinc Coatings	1259
<i>M.U.F. Khan and R.K. Gupta</i>	
Protective Coating on Solid Oxide Fuel Cell Interconnects	1267
<i>HongPeng He, Chen Chen, Dale Steedman, and Sofiane Benhaddad</i>	
Efficient FARADAYIC® Electrostripping of WC-Co Wear Coatings from Inconel® 718 Substrates	1275
<i>Brian T. Skinn, Heather A. McCrabb, Stephen T. Snyder, and Maria E. Inman</i>	
Environmentally Friendly Chromium Stripping	1283
<i>H. McCrabb, T. Hall, M. Inman, and E.J. Taylor</i>	

Symposium on Large Fluctuations and Collective Phenomena in Materials III

A Master Equation for Force Distributions in Dense Granular Materials	1293
<i>Kuniyasu Saitoh and Fumiko Ogushi</i>	

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

Effect of Thermal Deformation on Forging Bar Microstructure and Properties of Inconel 718 Alloy	1303
<i>Zhang Yuehong, Wang Qingzeng, Wang Zixing , Wu Jing, Dai Pengchao, and Tian Peiyu</i>	
Effect of Ni Content on Microstructure and Mechanical Properties of CoCrFeNi _x Ti _{0.3} High-Entropy Alloys	1311
<i>Tao-Tsung Shun, Che-Fu Lee, and Cheng-Ying Hsieh</i>	
Fabrication of Metal Matrix Syntactic Foams by a Laser Additive Manufacturing Process	1319
<i>M. Spratt, J.W. Newkirk, and K. Chandrashekara</i>	
Optimization of Powder Metallurgy (P/M) Route for Fabrication of Metal Matrix Composites Reinforced by Ultra High Temperature Ceramics	1327
<i>Babak Jahani, Mehdi Salimi Jazi, and Fardad Azarmi</i>	
Author Index	1335
Subject Index	1339