

TW  
MGI/546


# B

Process Metallurgy and Materials Processing Science

# METALLURGICAL AND MATERIALS TRANSACTIONS

Volume 45B • Number 4

August 2014

 Springer

TMS

  
ASM  
INTERNATIONAL

11663 • ISSN 1073-5615  
45B(4) 1171-1580 (2014)



# Contents

## COMMUNICATIONS

### Pyrometallurgy

*Juncheng Li, Zhancheng Guo, Jintao Gao, and Jingwei Li* 1171 Evaluation of Isothermal Separating Perovskite Phase from CaO-TiO<sub>2</sub>-SiO<sub>2</sub>-Al<sub>2</sub>O<sub>3</sub>-MgO Melt by Super Gravity

*Baijun Yan, Dongdong Guo, Zengwu Zhao, and Yan Li* 1175 Thermodynamics of Mn in Cu-Mn Melts

### Solidification

*Thomas Niendorf, Florian Brenne, and Mirko Schaper* 1181 Lattice Structures Manufactured by SLM: On the Effect of Geometrical Dimensions on Microstructure Evolution During Processing

*Jun-Yong Park, Jae Wook Ryu, and Il Sohn* 1186 *In-situ* Crystallization of Highly Volatile Commercial Mold Flux Using an Isolated Observation System in the Confocal Laser Scanning Microscope

### Materials Processing

*Zhiqiang Zhang, Xianshuang Li, Yong Zhao, and Xiangji Li* 1192 Heat Transfer in Hot Stamping of High-Strength Boron Steel Sheets

### Composite Materials

*Tadeusz Knych, Pawel Kwaśniewski, Grzegorz Kiesiewicz, Andrzej Mamala, Artur Kawecki, and Beata Smyrak* 1196 Characterization of Nanocarbon Copper Composites Manufactured in Metallurgical Synthesis Process

### Hydrometallurgy

*Ali Reza Mahmoudian, S. K. Sadrnezhad, and Zahra Manafi* 1204 Simulation of Bioleaching Heat Effects for Enhancement of Copper Recovery from Sarcheshmeh Chalcopyrite

### Pyrometallurgy

*Hyeon Jeong Cho, Ming Tang, and Petrus Christiaan Pistorius* 1213 Magnetite Particle Size Distribution and Pellet Oxidation

*Xiang Ding and Xing-Min Guo* 1221 The Formation Process of Silico-Ferrite of Calcium (SFC) from Binary Calcium Ferrite

*Ata Fallah-Mehrjardi, Peter C. Hayes, and Evgueni Jak* 1232 Investigation of Freeze-Linings in Aluminum Production Cells

*Min Jiang, Xin-Hua Wang, and Jong-Jin Pak* 1248 Formation of Low-Melting-Point Inclusions in Al-Deoxidized Steel Refined by High-Basicity Calcium Aluminate Slag in ZrO<sub>2</sub> Crucible Experiments

*Jungshin Kang and Toru H. Okabe* 1260 Thermodynamic Consideration of the Removal of Iron from Titanium Ore by Selective Chlorination

<i>Juncheng Li and Zhancheng Guo</i>	1272	Innovative Methodology to Enrich Britholite( $\text{Ca}_3\text{Ce}_2[(\text{Si,P})\text{O}_4]_3\text{F}$ ) Phase from Rare-Earth-Rich Slag by Super Gravity
<i>Wei Liu, Honglin Luo, Wenqing Qing, Yongxing Zheng, Kang Yang, and Junwei Han</i>	1281	Investigation into Oxygen-Enriched Bottom-Blown Stibnite and Direct Reduction
<i>Ying Ren, Yufeng Wang, Shusen Li, Lifeng Zhang, Xiangjun Zuo, Simon N. Lekakh, and Kent Peaslee</i>	1291	Detection of Non-metallic Inclusions in Steel Continuous Casting Billets
<i>Ming Tang, Hyeon Jeong Cho, and Petrus Christiaan Pistorius</i>	1304	Early Gaseous Oxygen Enrichment to Enhance Magnetite Pellet Oxidation
<b>Electrometallurgy</b>		
<i>Yan-Wu Dong, Zhou-Hua Jiang, Yu-Long Cao, Ang Yu, and Dong Hou</i>	1315	Effect of Slag on Inclusions During Electroslag Remelting Process of Die Steel
<i>Eric S. Gratz, Xiaofei Guan, Jarrod D. Milshtein, Uday B. Pal, and Adam C. Powell</i>	1325	Mitigating Electronic Current in Molten Flux for the Magnesium SOM Process
<i>Xiao Yang, Kouji Yasuda, Toshiyuki Nohira, Rika Hagiwara, and Takayuki Homma</i>	1337	Reaction Behavior of Stratified $\text{SiO}_2$ Granules during Electrochemical Reduction in Molten $\text{CaCl}_2$
<b>Transport Phenomena</b>		
<i>David R. Poirier</i>	1345	<b>Review Paper:</b> Density, Viscosity, and Diffusion Coefficients in Hypoeutectic Al-Si Liquid Alloys: An Assessment of Available Data
<i>G. Ramesh and K. Narayan Prabhu</i>	1355	Spatial Dependence of Heat Flux Transients and Wetting Behavior During Immersion Quenching of Inconel 600 Probe in Brine and Polymer Media
<b>Physical Chemistry</b>		
<i>Samar Emami, Hong Yong Sohn, and Hang Goo Kim</i>	1370	Formation and Evaluation of Protective Layer Over Magnesium Melt Under $\text{SF}_6$ /Air Atmospheres
<i>Jiwon Park, Seetharaman Sridhar, and Richard J. Fruehan</i>	1380	Kinetics of Reduction of $\text{SiO}_2$ in $\text{SiO}_2$ - $\text{Al}_2\text{O}_3$ - $\text{CaO}$ Slags by Al in Fe-Al(-Si) Melts
<i>Kai Zheng, Zuotai Zhang, Lili Liu, and Xidong Wang</i>	1389	Investigation of the Viscosity and Structural Properties of $\text{CaO}$ - $\text{SiO}_2$ - $\text{TiO}_2$ Slags
<b>Solidification</b>		
<i>Mahmoud Ahmed El-Sayed, Hanadi A. G. Salem, Abdelrazek Youssef Kandeil, and W. D. Griffiths</i>	1398	Determination of the Lifetime of a Double-Oxide Film in Al Castings
<i>J. B. Ferguson, Meysam Tabandeh-Khorshid, John C. Mantas, Pradeep K. Rohatgi, Kyu Cho, and Chang-Soo Kim</i>	1407	Predicting the Effect of Pouring Temperature on the Crystallite Density, Remelting, and Crystal Growth Kinetics in the Solidification of Aluminum Alloys
<i>Takuya Ide, Akihiro Tsunemi, and Hideo Nakajima</i>	1418	Fabrication of Porous Copper with Directional Pores by Continuous Casting Technique Through Thermal Decomposition of Hydride

<i>Maria Rita Ridolfi</i>	1425	Hot Tearing Modeling: A Microstructural Approach Applied to Steel Solidification
<i>Ken-ichi Sugioka, Takamitsu Inoue, Tsubasa Kitahara, Ryo Kurosawa, Masaki Kubo, Takao Tsukada, Masahito Uchikoshi, and Hiroyuki Fukuyama</i>	1439	Study on the Effect of Melt Convection on Phase Separation Structures in Undercooled CuCo Alloys Using an Electromagnetic Levitator Superimposed with a Static Magnetic Field
<i>Yongqi Sun, Jing Li, Xidong Wang, and Zuotai Zhang</i>	1446	The Effect of P <sub>2</sub> O <sub>5</sub> on the Crystallization Behaviors of Ti-Bearing Blast Furnace Slags Using Single Hot Thermocouple Technique
<i>Sudeep Verma and Anupam Dewan</i>	1456	<b>Review Paper:</b> Solidification Modeling: Evolution, Benchmarks, Trends in Handling Turbulence, and Future Directions
<b>Materials Processing</b>		
<i>Rouholah Ashiri</i>	1472	Analysis and Characterization of Relationships Between the Processing and Optical Responses of Amorphous BaTiO <sub>3</sub> Nanofilm Obtained by an Improved Wet Chemical Process
<i>Reza Abdi Behnagh, Ramezanali Mahdavejad, Amin Yavari, Masoud Abdollahi, and Morteza Narvan</i>	1484	Production of Wire From AA7277 Aluminum Chips via Friction-Stir Extrusion (FSE)
<i>H. M. Guo, L. J. Wang, Q. Wang, and X. J. Yang</i>	1490	Effects of Solid-Liquid Mixing on Microstructure of Semi-Solid A356 Aluminum Alloy
<i>Boxun Lu, Kun Chen, Wanlin Wang, and Binbin Jiang</i>	1496	Effects of Li <sub>2</sub> O and Na <sub>2</sub> O on the Crystallization Behavior of Lime-Alumina-Based Mold Flux for Casting High-Al Steels
<i>Huan Zhao, Wanlin Wang, Lejun Zhou, Boxun Lu, and Youn-Bae Kang</i>	1510	Effects of MnO on Crystallization, Melting, and Heat Transfer of CaO-Al <sub>2</sub> O <sub>3</sub> -Based Mold Flux Used for High Al-TRIP Steel Casting
<b>Welding and Joining</b>		
<i>Yousub Lee, Mark Nordin, Sudarsanam Suresh Babu, and Dave F. Farson</i>	1520	Effect of Fluid Convection on Dendrite Arm Spacing in Laser Deposition
<b>Mathematical Modeling</b>		
<i>K. Babu and T. S. Prasanna Kumar</i>	1530	Comparison of Austenite Decomposition Models During Finite Element Simulation of Water Quenching and Air Cooling of AISI 4140 Steel
<i>Jian Yang, Zhi Xie, Jing Ning, Wenhong Liu, and Zhenping Ji</i>	1545	A Framework for Soft Sensing of Liquid Pool Length of Continuous Casting Round Blooms
<b>Light Metals</b>		
<i>Hasan Alkhazraji, Mohammed Z. Salih, Zhengye Zhong, Mansour Mhaede, Hans-Günter Brokmeier, Lothar Wagner, and N. Schell</i>	1557	Estimation of Dislocation Density in Cold-Rolled Commercially Pure Titanium by Using Synchrotron Diffraction

*Matthew S. Walker and Richard J. Fruehan* 1565 Experimental Verification of the Thermodynamics of Critical Aspects of the Carbothermic Reduction of Alumina. Part II: Thermogravimetric Study of the Reaction of  $\text{Al}_2\text{O}_3\text{-C}$  Mixtures and the  $\text{Al}_2\text{O}_3\text{-Al}_4\text{C}_3$  Phase Diagram

### Materials and Energy

*Wenzhou Yu, Wenhui Ma, Guoqiang Lv, Yongsheng Ren, Yongnian Dai, and Kazuki Morita* 1573 Low-Cost Process for Silicon Purification with Bubble Adsorption in Al-Si Melt

### Errata

*Hasan Alkhazraji, Mohammed Z. Salih, Zhengye Zhong, Mansour Mhaede, Heinz-Günter Brokmeier, Lothar Wagner, and N. Schell* 1579 Erratum to: Estimation of Dislocation Density in Cold-Rolled Commercially Pure Titanium by Using Synchrotron Diffraction

*Ye Wang, Xiaodong Ma, and Kazuki Morita* 1580 Erratum to: Evaporation Removal of Boron from Metallurgical-Grade Silicon Using  $\text{CaO-CaCl}_2\text{-SiO}_2$  Slag

The contents for the latest issue of *Metallurgical and Materials Transactions A* can be found online at: <http://link.springer.com/journal/VolumesAndIssues/11661>

**DISCLAIMER.** The acceptance and publication of manuscripts in METALLURGICAL AND MATERIALS TRANSACTIONS does not imply that the reviewers, key readers, editors, or the sponsoring Societies (ASM International and The Minerals, Metals & Materials Society) accept, approve, or endorse the data, opinions, and conclusions of authors. While manuscripts published in METALLURGICAL AND MATERIALS TRANSACTIONS are intended to have archival significance, authors' data and interpretations are frequently insufficient to be directly translatable to specific design, production, testing or performance applications without independent examination and verification of their applicability and suitability by professionally qualified personnel.