

Contents

Chapter 1 Overviews

1) Innovation and development in comprehensive utilization of slag in China's iron and steel industry, Kuangdi XU	1
2) Evolution of published research on molten slags and fluxes in the second millennium, Rob BOOM, S. RIAZ, Yanping XIAO and Kenneth C. MILLS	2
3) Renewable energy and the role of molten salts and carbon, Derek FRAY	4
4) Exploring compositional space in metallurgical slag systems, Peter HAYES and Evgueni JAK	6
5) The factors affecting thermophysical properties of slags and glasses, Kenneth C. Mills, Lang. YUAN, Zushu Li, Kuo-Chih CHOU and Guohua ZHANG	7
6) A lower carbon foot print process for electrolytic production of metals from oxides dissolved in molten salts, Uday B. PAL	8
7) Molten salt thermal energy storage materials for solar power generation, Ramana REDDY	9
8) Improvement of function and utilization of steelmaking slag, Hiroyuki MATSUURA, Xiaojun HU and Fumitaka TSUKIHASHI	10
9) Calculation of physicochemical properties in molten melts, Kuo-Chih Chou, Guohua Zhang, Zhiyuan Chen and Lijun Wang	12

Chapter 2 Phase Equilibria, Phase Diagram and Their Applications

1) Effect of slag composition on the solubility of rhodium in molten silicate slags, Chompunoot WIRASERANEE, Toru H. OKABE and Kazuki MORITA	13
2) Integrated experimental and thermodynamic modelling research methodology for metallurgical slags with examples in the copper production field, Evgueni JAK	14
3) Vanadium recovery from combustion ash of Orinoco tar occurred in Venezuela, Hironori MURAO, Takahiro MIKI and Mitsutaka HINO	16
4) Thermodynamic investigation on the Mn-V-O oxide system and Gibbs energy of formation of MnV ₂ O ₄ spinel solid solution, Min Su Kim, Youn Bae Kang, Hae Geon Lee and Woo Yeol Cha	17
5) Development of NiO-CaO-MgO-SiO ₂ thermodynamic database using experimental and thermodynamic modelling approaches with focus on NiO-MgO-SiO ₂ and NiO-CaO-SiO ₂ systems, Jiang CHEN, Viktoria PROSTAKOVA, Evgueni JAK and Sergei A. DECTEROV	18
6) Phase equilibria at liquidus temperatures of the CaO-SiO ₂ -Na ₂ O · SiO ₂ -Na ₂ O · Al ₂ O ₃ · 6SiO ₂ slag system, Zhan ZHANG, Yanping XIAO, Jack VONCKEN, Yongxiang YANG, Rob BOOM, Nan WANG and Zongshu ZOU	19
7) Experimental study on the liquidus of ladle slags, Jimmy GRAN and DU Sichen	20

8) Liquidus and phase equilibria in $\text{CaO-SiO}_2\text{-FeOx-Al}_2\text{O}_3$ system under intermediate oxygen partial pressure, <i>Nan WANG, Shuichao CHEN, Zongshu ZOU, Zhan ZHANG, Yanping XIAO and Yongxiang YANG</i>	21
9) Effects of CaO , Al_2O_3 and MgO on liquidus temperature of copper smelting and converting slags under controlled oxygen partial pressure, <i>Baojun ZHAO, Peter HAYES and Evgueni JAK</i>	22
10) A study on phase equilibria in the $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2\text{-"Nb}_2\text{O}_5\text{"}$ (5 mass%) system in reducing atmosphere, <i>Baijun YAN, Ruibing GUO and Jiayun ZHANG</i>	23
11) Thermodynamic calculations of complex heterogeneous systems involving multicomponent slags, melts and salts, <i>Pingfang SHI and Johan BRATBERG</i>	25
12) Phase equilibria of " Cu_2O "-" FeO "- $\text{SiO}_2\text{-CaO}$ slags at PO_2 at 10^{-8} atm in equilibrium with metallic copper, <i>Hector M. HENAO, Peter C. HAYES and Evgueni JAK</i>	27
13) A Phase equilibriums in the "liquid metal-nonmetallic and intermetallic complex phases, including molten slags, fluxes and salts" systems, <i>Evgeny TROFIMOV</i>	28

Chapter 3 Structure and Thermodynamic Properties of Molten Systems

1) On the thermodynamic and physical properties of ionic melts and on their role in ferrous and nonferrous metals production processes, <i>Heikki JALKANEN, Sonja NURMI and Seppo LOUHENKILPI</i>	29
2) The main thermo-statistical models of metallurgical slags: theory and applications, <i>J. LEHMANN, In-Ho JUNG and L. ZHANG</i>	30
3) Thermodynamic properties and vaporization processes of the ionic silicate melts, <i>Valentina STOLYAROVA</i>	31
4) Application of general solution model in estimating thermodynamic and other physical properties of multicomponent metal systems, <i>Dragana Živković, Živan Živković and Kuo Chi Chou</i>	32
5) Coupled experimental and thermodynamic modeling study of the CaO-CaF_2 system, <i>Dong-Geun KIM, Marie-Aline Van ENDE, Christian LIEBSKE, Corrie van HOEK, Seiger van der LAAN, Pierre HUDON and In-Ho JUNG</i>	33
6) Computational materials design with Pandat, <i>Shuanglin CHEN, Fan ZHANG, Weisheng CAO, Chuan ZHANG and Jieju ZHANG</i>	35
7) Application of the generalised central atom model to sulphur containing oxide slags, <i>Ling ZHANG and Jean LEHMANN</i>	36
8) Thermodynamic assessment of $\text{V}_2\text{O}_3\text{-TiO}_2$ system, <i>Hongbin WANG, Guangxiang TAN, Ming ZHU, Aitao QIU, Xionggang LU and Chonghe LI</i>	37
9) Experimental investigation of phase equilibria and thermodynamic modeling of the $\text{CaO-SiO}_2\text{-Al}_2\text{O}_3\text{-CaS}$ oxysulfide system, <i>RongXun PIAO, Youn-Bae KANG and Hae-Geon LEE</i>	38

10) Applicability of commercially available slag models for steel making slag, <i>Somnath BASU, Seshadri SEETHARAMAN, Ashok LAHIRI</i>	39
11) Thermodynamic assessment of the CaO-Na ₂ O-SiO ₂ slag system, <i>Zhan ZHANG, Yanping XIAO, Jack VONCKEN, Yongxiang YANG, Rob BOOM, Nan WANG and Zongshu ZOU</i>	40
12) Investigation of the structural properties of calcium aluminosilicate slags with varying Al ₂ O ₃ /SiO ₂ ratios using molecular dynamics, <i>Kai ZHENG, Zuotai ZHANG, Feihua YANG and Seetharaman SRIDHAR</i>	42
13) Thermodynamics of indium dissolution in molten CaO-base slags, <i>Kyu Yeol KO and Joo Hyun PARK</i>	43
14) Thermodynamic modelling of phosphorus in steelmaking slags, <i>Chunlin CHEN, Ling ZHANG and Jean LEHMANN</i>	44
15) Thermodynamic fundamentals of deoxidation equilibria, <i>Jian ZHANG</i>	45
16) Effect of low oxygen partial pressure on the chromium partition in CaO-MgO- SiO ₂ -Cr ₂ O ₃ -Al ₂ O ₃ synthetic slag at elevated temperatures, <i>Galina JELKINA, Lidong TENG,, Bo BJOKMAN and Seshadri SEETHARAMAN</i>	46
17) The relationship between silicate structure and mass transfer of boron in slag refining of silicon, <i>Egil KRYSTAD, Jeffery KLINE, Merete TANGSTAD and GABRIELLA TRANELL</i>	47
18) Investigation of freeze linings in copper containing slag systems, <i>Ata Fallah MEHRJARDI, Peter HAYES and Evgueni JAK</i>	48
19) Modeling activity and interaction coefficients of components of multicomponent alloy melts: An example of iron melt, <i>Ning Zhang, Xingqiu Chen, Xueyong Ding, Kuo-Chih Chou</i>	49
20) A thermodynamic optimization of “Cu ₂ O”-containing slags systems, <i>Taufiq HIDAYAT and Evgueni JAK</i>	50
21) Thermodynamic analysis of the CaO-SiO ₂ -M ₂ O (M=K, Na) systems, <i>Ligang ZHANG, Volker KAHLENBERG, Clemens SCHMETTERER and Patrick J. MASSET</i>	51
22) A thermodynamic model for evaluation of mass action concentrations of Ce ₂ O ₃ -contained slag systems based on the ion and molecule coexistence theory, <i>Chengchuan WU, Guoguang CHENG, Hu LONG and Xiaohong YANG</i>	52
23) Ferric-ferrous equilibrium in low-iron sodium-silicate glasses, <i>E. Dunaeva, K. POKHOLOK, N. EFIMOV, V. MININ, E. BRUNET and S. MÜLLER</i>	53
24) Hydrogen Solubility in the CaF ₂ -CaO-SiO ₂ Type Welding Fluxes and Its Correlation to the Flux Structure, <i>Jun-Yong Park, Woong-Seong Chang, Seo Jeong Park, and Il Sohn</i>	55

Chapter 4 Physical Properties of Ionic Melts-Viscosity, Modeling and Measurement

1) Effect of alkaline/alkaline-earth oxides on viscous behavior of iron-making slag system, <i>Wan Ho KIM, Dong Joon MIN</i>	56
--	----

2) Linking Thermodynamics, Structure and Viscosity of Oxide Melts, <i>Arthur D. PELTEN, Sergei A. DECTEROV, Wan-Yi KIM, Nicholas GRUNDY and Eli BROSH</i>	57
3) Fundamental research and application of blast furnace slag, <i>Xidong WANG, Dawei ZHAO, Rong WANG, Limin HOU and Junlin LIAO</i>	58
4) Effect of oxidation state of iron ions on the viscosity of silicate melts, <i>Sohei SUKENAGA, Takeshi OHSUGI, Yosuke INATOMI, Yoshiaki GONDA, Takashi WATANABE, Noritaka SAITO and Kunihiko NAKASHIMA</i>	59
5) Revision of quasi-chemical viscosity model for viscosity estimation of molten multi-component oxide slag, <i>Masanori SUZUKI and Evgueni JAK</i>	60
6) Modeling the viscosities of alumino-silicate melts, <i>Guohua Zhang and Kuochih Chou</i>	61
7) Prediction and measurement of the coal slag viscosity including the influence of solid particle fractions, <i>Arne M. BRONSCH, Marc A. DUCHESNE, Patrick J. MASSET and Clemens SCHMETTERER</i>	62
8) Effects of measurement materials and oxygen partial pressure on measurements of synthetic coal slag viscosity values, <i>Jingxi ZHU, Tetsuya KANEKO, Haoyuan MU, James BENNETT and Seetharaman SRIDHAR</i>	63
9) Viscosity measurements of high “Cu ₂ O” containing slags in the “Cu ₂ O”-SiO ₂ -Al ₂ O ₃ system in equilibrium with metallic Cu, <i>Mao CHEN, Baojun ZHAO and Evgueni JAK</i>	64
10) Concepts and measurement of velocities and viscosities at the slag-metal interface, <i>Luckman MUHMOOD, Nurni N VISWANAHAN and Seshadri SEETHARAMAN</i>	65
11) Rheological analysis of blast furnace synthetic slag admixtures of Al ₂ O ₃ , <i>Piotr MIGAS, Marta KOROLCZUK-HEJNAK and Mirosław KARBOWNICZEK</i>	67
12) Modeling viscosity of molten slags and glasses, <i>Wan-Yi Kim, Sergei A. DecteroV, A. Nicholas Grundy, Eli Brosh, In-Ho Jung, Eve Bélisle, Christopher Bale and Arthur D. Pelton</i>	68
13) Liquidus temperatures and viscosities of Shougang iron blast furnace slags, <i>Baojun ZHAO, Dianwei ZHANG, Zhixing ZHAO, Evgueni JAK and Peter HAYES</i>	69
14) Accuracy of viscosity measurement using rotation viscometer, <i>Lijia WU, Peter HELLER, Xuegong BI and Piotr R. SCHELLER</i>	70
15) A model for estimating viscosity of molten silicate slag based on slag structure theory, <i>Jing GUO, Shusen CHENG and Hongbo ZHAO</i>	71

Chapter 5 Physical Properties of Ionic Melts-Transport Properties

1) Interaction of ions in molten slag, salts and oxide compounds on diffusion, <i>Kazuhiro NAGATA</i>	73
2) Thermal conductivity of R-Na ₂ O-SiO ₂ (R=Al ₂ O ₃ , CaO) melts, <i>Ohta HIROMICHI, Hiroyuki SHIBATA, Hiroki HASEGAWA, Takaya KOWATARI, Yasuhiro SHIROKI, Shin-Ya KITAMURA and Yoshio WASEDA</i>	74

3) Thermal conductivity measurements of ladle slag using the transient Hot-Wire-Method, Björn GLASER and DU Sichen	75
4) An evaluation of thermophysical property models for CaO-MnO-SiO ₂ -Al ₂ O ₃ -MgO slag, Jacques MULLER and Joalet D. STEENKAMP.....	76
5) The physical properties of CaF ₂ -CaO-Al ₂ O ₃ -SiO ₂ slag system for ESR of 12Cr, Xiaohua WANG, Ying LI, Chen YAN, Beiyue MA and Jie ZENG	78
6) Evaluating the chemical diffusion coefficient of sulfur in slag by metal analysis: model concept and experiments, Luckman MUHMOOD, Nurni N. VISWANATHAN and Seshadri SEETHARAMAN.....	79
7) Applied research on electrical conductivity of slag in metallurgical reaction, Jixiang JIA, Xiangwei LIAO, Degang LI, Chongyi NI, Gang ZHAO and Dong CAO.....	80

Chapter 6 Surface Tension, Interfacial phenomena and Foaming

1) Surface properties of liquid alloys & molten slag, Toshihiro TANAKA	81
2) Ionicity of molten slags and other high temperature melts-properties and applications, Shouyi SUN	83
3) Estimate of the surface tension and the viscosity of the slag in the magnesium injection process, Shuang-Shii LIAN, Wu Tian CHENG,, Guling ZHANG and Mu Rong LU	84
4) Determination of thermophysical properties for molten slags by maximum bubble pressure method, Tobias DUBBERSTEIN, Hans-Peter HELLER and Piotr R. SCHELLER.....	85
5) Density measurements of low silica CaO-SiO ₂ -Al ₂ O ₃ slags: slag structure discussions, Luckman MUHMOOD, Lijun WANG and Seshadri SEETHARAMAN	86
6) Density of molten CaO-MnO-SiO ₂ slag, Joonho LEE, Le Thu HOAI, Joongkil CHOE and Joo-Hyun PARK.....	87
7) A sessile droplet study of iron-carbon-sulfur alloys on alumina substrate, Aida ABBASALIZADEH, L. MUHMOOD, A. Danaei, Y.D. Yang, M. Barati, Alexander McLEAN and Seshadri SEETHARAMAN	88
8) Surface tension of selected CaO-MgO-Al ₂ O ₃ -SiO ₂ slag with low silica content, Jifang XU, Jieyu ZHANG, Tang ZENG, Jianchao LI and Kuochih CHOU	89
9) Slag foaming by carbonates addition: studies of enthalpy and kinetics, Andrei CHYCHKO, Seshadri SEETHARAMAN and Lidong TENG	90
10) Transient modeling of slag foaming using computer fluid dynamics simulations, Eder TREJO, Lidong TENG, Alejandro MONTESINOS and Seshadri SEETHARAMAN	91

Chapter 7 Slag Reaction Thermodynamics and Slag Capacities

1) Sulfide capacity of molten CaO-SiO ₂ -MnO-Al ₂ O ₃ -MgO slags, Joo Hyun PARK and Geun Ho PARK	92
---	----

2) Custom-designed fluxes for refining nickel alloys, <i>Yindong YANG, Mansoor BARATI and Alexander McLEAN</i>	93
3) Relationships between sulfur distribution ratio of molten slag and metal and that of tellurium, <i>Atsushi OKAYAMA and Takayuki NISHI</i>	94
4) Development of H ₂ production process with utilization of steelmaking slag, <i>Hiroyuki MATSUURA, Makoto SATO and Fumitaka TSUKIHASHI</i>	95
5) The effect of Na ₂ O and K ₂ O flux on the phosphorus distribution ratio between CaO-SiO ₂ -Fe ₂ O ₃ -P ₂ O ₅ slags and carbon saturated iron, <i>Guangqiang LI, Chengyi ZHU, Yongjun LI, Xiongyuan HUANG and Min CHEN</i>	97
6) Effect of slag composition on the distribution behavior of Pb between Fe ₂ O-SiO ₂ (-CaO,Al ₂ O ₃) slag and molten copper, <i>Jung Ho HEO, Soo Sang PARK and Joo Hyun PARK</i>	98
7) Effect of Al ₂ O ₃ content on alkali holding capacity of blast furnace slag and related liquids, <i>Pekka A. TANSKANEN, Timo PAANANEN and Eetu-Pekka HEIKKINEN</i>	99
8) The Distribution of Boron between SiO ₂ -CaO-MgO Slags and Liquid Silicon at Controlled Oxygen and Nitrogen Potentials, <i>Jesse WHITE, Carl ALLERTZ, Karl FORWALD and DU Sichen</i>	101
9) Removal of boron and phosphorus from silicon using CaO-SiO ₂ -Na ₂ O-Al ₂ O ₃ flux, <i>Mark Xiang LI, Torstein UTIGARD, and Mansoor BARATI</i>	102
10) Slag structure information derived from sulphide capacities, <i>Lijun WANG, Miyuki HAYASHI, Kuochih CHOU and Seshadri SEETHARAMAN</i>	103
11) Equilibrium of CaO-SiO ₂ -FeO-P ₂ O ₅ multi phase flux at 1673K with low oxygen partial pressure for dephosphorization, <i>Xu GAO, Hiroyuki MATSUURA and Fumitaka TSUKIHASHI</i>	104
12) Thermodynamic studies on selective oxidation of Nb, P and C in dephosphorization of low niobium hot metal, <i>Yongli JIN, Zengwu ZHAO, Jieyu Zhang and Baowei LI</i>	105
13) Thermodynamic modeling of the Mn and Cr reduction from slag, <i>Anatoly SENIN</i>	107

Chapter 8 Kinetics of High Temperature Reactions

1) Progress in the kinetics of slag-metal-gas reactions, past, present and future, <i>Kenneth S. COLEY</i>	108
2) Rate and mechanism of reduction-dissolution of chromite in liquid slags, <i>O DEMIR and R Hurman ERIC</i>	109
3) Transient Interaction between molten iron, alumina lining refractory and slag, <i>Yongfeng CHEN, Jiling WANG and Lifeng ZHANG</i>	110
4) Dissolution of lime into BOS slags: from laboratory experiment to industrial converter, <i>Zushu LI, Martyn WHITWOOD, Stuart MILLMAN and Johan van BOGGELEN</i>	111

5) Integration of phase diagram calculation with kinetic models for the simulation of materials properties, <i>Fan ZHANG, Weisheng CAO, Shuanglin CHEN and Chuan ZHANG</i>	113
6) A study on the process of removing sulfide in steel surface layer by molten salt electrolysis, <i>Liguang ZHU, Ying XU, Xingjuan WANG and Xinhua ZHU</i>	114
7) Coupled reaction kinetics of the duplex melting process of high phosphorus hotmetal, <i>Xie ZHANG, Bing XIE, Jiang DIAO and Chengqing JI</i>	115
8) Kinetics of reduction of titanomagnetite powder by H ₂ , <i>Jie DANG, Xiaojun HU, Guohua ZHANG, Xinmei HOU, Xiaobo YANG and Kuochih CHOU</i>	116
9) Study on the corrosion mechanism between MgO-CaO refractories and refining slag, <i>Yanwen YU and Yuxi ZHAO</i>	118
10) Mechanism of slag chemical composition change in ESR process, <i>Junxue ZHAO, Hongming LING, Zhenqiang ZHANG, Yanmei CHEN, Xiaoming LI and Jiantao JU</i>	119
11) Reduction kinetics of lead-rich isasmelt slag at the temperature range of 1073 to 1473K, <i>Xinmei HOU, Baojun ZHAO and Kuochih CHOU</i>	120
12) The mechanism of dross formation in the hot-dip 55 wt.% Al-Zn-Si coating process, <i>Qun LUO, Yang LI, Feng JIN, Qian LI, Jieyu ZHANG and Kuochih CHOU</i>	121
13) Investigation of the impact of oxygen potential on sulfur mass transfer at slag/iron interface, <i>Weimin CAO, Luckman MUHMOOD and Seshadri SEETHARAMAN</i>	122
14) Reduction of metallic oxides in liquid slag systems by solid graphite, <i>Marta KOROLCZUK-HEJNAK, Piotr MIGAS, Wojciech ŚLEZAK and Mirosław KARBOWNICZEK</i>	123
15) Kinetic studies of reduction of chromium oxide from complex oxidic melts in presence of metallic iron, <i>Xianfeng HU, Lidong TENG and Seshadri SEETHARAMAN</i>	124
16) Effect of water-vapor content on reaction rate of hexagonal BN powder at 1273K, <i>Ziyou YU, Xinmei HOU, Zhiyuan CHEN and Kuo-Chih CHOU</i>	125

Chapter 9 Transport Phenomina and Process Simulation

1) The fluid mechanics of slag-metal interactions in ladle metallurgy, <i>Krishnakumar KRISHNAPISHARODY and Gordon A. IRONS</i>	126
2) KTH steel scrap model –iron and steel flow in the Swedish society 1889-2010, <i>Alicia GAUFFIN, Sven EKEROT, Anders TILLIANDER and Pär JÖNSSON</i>	127
3) Study of Droplets in converter slag, <i>Mattias Ek and Du Sichen</i>	128
4) Study on lime dissolution in converter slag, <i>Tengfei DENG and DU Sichen</i>	129
5) Mathematical model of scrap melting in EAF using electromagnetic stirring, <i>Niloofar ARZPEYMA, Mikael ERSSON, Ola WIDLUND and Pär JÖNSSON</i>	130

6) Mathematical simulation of multiphase steelmaking reactions in the electric arc furnace, <i>Rodolfo D. MORALES, M. MACIAS-HERNANDEZ, Ruben G. LULE and FRANCISCOLOPEZ</i>	131
--	-----

Chapter 10 Slags in Ironmaking, Steelmaking and Ferroalloy production

1) Slags in production of manganese alloys, <i>Oleg OSTROVSKI and Doug SWINBOURNE</i>	132
2) Slag related research in the 'Steel Eco-Cycle'-A Swedish national environmental research programme, <i>Göran ANDERSSON</i>	133
3) Gasifier refractories, coal slags, and their interaction, <i>Kyeising KWONG, James BENNETT and Jinichiro NAKANO</i>	135
4) Decarburization of ferrochrome and high alloy steels with optimized gas and slag phases towards improved Cr retention, <i>Haijuan WANG, Mselly M. NZOTTA, Lidong TENG and Seshadri SEETHARAMAN</i>	136
5) Study on structure changes of molten blast furnace slag (BFS) during cooling process, <i>Yu LI, Xiaoming LIU, Henghu SUN and Daqiang CANG</i>	137
6) Study on the permeability index of COREX melter gisifer and its influencing factors, <i>Wenlong ZHAN, Keng WU, Yong ZHAO and Erhua ZHANG</i>	138
7) Reducing dephosphorization of SiMn alloy by molten CaO-CaF ₂ flux and thermodynamic stability of Ca ₃ P ₂ , under atmospheric cooling conditions, <i>Jae Hong SHIN, Sung Dae JEON and Joo Hyun PARK</i>	139
8) Thermodynamic database of P ₂ O ₅ containing oxide system for De-P process in steelmaking, <i>In-Ho JUNG, Pierre HUDON, Wan-Yi KIM, Marie-Aline VAN ENDE, Miftaur RAHMAN, Gabriel Garcia CURIEL and Elmira Moosavi KHOONSARI</i>	141
9) Investigation of blowing high silicon hot metal by double slag process, <i>Ku-Ling CHANG, Win-Jay HWANG and Wen-Hsien CHOU</i>	142
10) Analysis and control for desiliconization process of low niobium hot metal by experimental approach, <i>Zengwu ZHAO, Zhangyin XU and Baowei LI</i>	143
11) Sustainable steel decarburization, <i>Othman ALZEGHAIBI, Charles SORRELL and Veena SAHAJWALLA</i>	144
12) Optimisation of hot metal desulphurisation slag in the CaO/Mg Co-injection process to improve slag skimming performance, <i>Zushu LI, Mick BUGDOL and Wim CRAMA</i>	145
13) The study on sulfur and nickel distribution behavior of nickel between Fe-Ni alloy and MgO-FeO-SiO ₂ slag system, <i>Ki deok KIM, Hyung Sub EOM, Wan Wook HUH and Dong Joon MIN</i>	146

Chapter 11 Slags in Steel Refining and Alloying Steel Production

- 1) Some considerations of copper removal from steel by use of oxysulfide systems, *Sung-Hoon JUNG, Youn-Bae KANG, Jeong-Do SEO and Hae-Geon LEE* 147
- 2) Beneficial effects of molten silicates on the oxidation of Type 304 stainless steel under slab reheating conditions, *P. Chris PISTORIUS and Kelvin H. CHEUNG* 148
- 3) Possibilities to obtain feedback on inclusion characteristics during ladle refining, *Andrey KARASEV, Keiji NAKAJIMA and Pär G JÖNSSON* 149
- 4) A study on transformation of some transition metals oxides in molten steelmaking slag to magnetically susceptible compounds, *Volodymyr SHATOKHA, Anna SEMYKINA, Jinichiro Nakano, Seetharaman SRIDHAR and Seshadri SEETHARAMAN* 150
- 5) The formation of an inner slag layer during the dissolution of MgO particles in ladle slag, *Deyong WANG, Maofa JIANG, Xiaobing LI, Tongsheng ZHANG and Chengjun LIU* 152
- 6) Desulphurization of stainless steel by using CaO-Al₂O₃ based slags during secondary metallurgy, *P. YAN, M. GUO, X. GUO, S. HUANG, P. T. JONES, J. V. DYCK, J. WEYTJEN and B. BLANPAIN* 153
- 7) Slag formation during the steel refining process in a ladle furnace combined with the vacuum treatment, *Jan FALKUS, Katarzyna MILKOWSKA-PISZCZEK, Lechoslaw TRĘBACZ, Paweł DROŹDŹ, Tomasz KARGUL, Jacob LAMUT and Alojz ROZMAN* 154
- 8) Slag in the process of ESR: executive part and urgent tasks, *Lev MEDOVAR, Zhouhua JIANG, Ganna STOVPCHENKO and Liudmyla REDUN* 155
- 9) Modeling of chromium oxide separation to liquid slag and effect of top slag on decarburization in an AOD converter, *Nils ANDERSSON, Anders TILLIANDER, Lage T. I. JONSSON and Pär G. JÖNSSON* 157
- 10) Slag in the process of ESR: executive part and urgent tasks, *Lev MEDOVAR, Zhouhua JIANG, Ganna STOVPCHENKO and Liudmyla REDUN* 158
- 11) In situ observation of the evolution of intragranular acicular ferrite at Mg-containing inclusions in 16Mn Steel, *Bin WEN and Bo SONG* 160
- 12) Three-dimensional evaluation of inclusions during the production of stainless steel, *Yanyan BI, Erik ROOS, Andrey KARASEV and Pär G. JÖNSSON* 161
- 13) Usage of worked-out metallurgical slag in electroslag remelting processes, *Vasily E. ROSHCHIN, Nikolay V. MALKOV and Anton V. ROSHCHIN* 162
- 14) Thermodynamic determination of low melting area in CaO- Al₂O₃ -SiO₂ -MgO- MnO system inclusion and its control in spring steel, *Bo ZHANG, Fuming WANG and Changrong LI* 164
- 15) Application of inoculators-macrochillers at electroslagremelting, *Ilia CHUMANOV* 165

Chaper 12 Fluxes and Countinuos Casting

1) Slag emulsification in the continuous casting process, <i>Piotr R. SCHELLER and Rene HAGEMANN</i>	166
2) Hydrogen-induced sticker breakouts in continuous casting of steels: chemical reactions among ambient atmosphere, molten flux, molten steel and solidified shell, <i>Yoshiyuki UESHIMA, Toshiaki MIZOGUCHI and Toshiyuki KAJITANI</i>	167
3) Active tundish slag, <i>Lauri HOLAPPA, Marko KEKKONEN, Seppo Louhenkilpi, Rene HAGEMANN, Christina SCHRÖDER and Piotr SCHELLER</i>	168
4) Study of basicity impact on mold flux crystallization and radiative heat transfer in continuous casting, <i>Wanlin WANG, Lejun ZHOU, Kezhuan GU and Fanjun MA</i>	169
5) Study on crystallizing properties of mold fluxes in electric field, <i>Yanhui WANG, Yu WANG, Likai FAN, Bing XIE, Xiaoping LIANG, Xiaolan ZENG and Zhiwen WEI</i>	170
6) Development of CaO-Al ₂ O ₃ based mold flux system for high aluminum TRIP casting, <i>Jung-Wook CHO, Kenneth E. BLAZEK, Michael J. FRAZEE, Hongbin YIN and Sang-Woon MOON</i>	172
7) Effects of B ₂ O ₃ and TiO ₂ on crystallization behavior of some slags in Al ₂ O ₃ -CaO-MgO-Na ₂ O-SiO ₂ system, <i>Qifeng SHU, Zhen WANG, Jeferson L. KLUG¹, Kuochih CHOU and Piotr R. SCHELLER</i>	173
8) Effects of flux materials on the fire assay of oxide gold ores, <i>Haluk Ozden BASARAN, Ahmet TURAN and Onuralp YUCEL</i>	175
9) Investigation of continuous casting slag films sampled on site and comparison with laboratory results, <i>Irmtraud MARSCHALL, Nathalie KÖLBL, Harald HARNMUTH and Guangmin XIA</i>	176
10) Oxidative removal of Cu from carbon-saturated iron via Ag phase into B ₂ O ₃ flux, <i>Hideki ONO and Katsuhiro YAMAGUCHI</i>	177
11) Industrial mould slags for continuous casting of stainless steel-analysis of the crystallisation behaviour using the hot thermocouple technique, <i>Marko PETAJAJARVI, Jeferson KLUG, Paavo HOOLI, Hans P. HELLER and Piotr SCHELLER</i>	178
12) Study of the Solidification Behaviour of Metallurgical Slags using the Single Hot Thermocouple Technique, <i>Jeferson L. Klug , R. Hagemann, Nestor C. Heck, Antônio C. F. Vilela , Hans P. Heller and Piotr R. Scheller</i>	179
13) Study on structure characteristics of B ₂ O ₃ and TiO ₂ -bearing F-free mold flux by Raman spectroscopy, <i>Zhen WANG, Qifeng SHU and Kuochih CHOU</i>	180
14) Mould powder benchmarking for peritectic grade of steel at Tata Steel, <i>Pradipta P. SAHOO and Arghya DEY</i>	182

Chapter 13 Slag and matte in ferrometallurgy

- 1) Freeze-lining formation and microstructure in a direct-to-blister flash smelting slag, *Pekka TASKINEN, Markku KASKIALA, Kaisa MIETTINEN and Jani JANSSON* 183
- 2) A study on copper recovery from the slag of Outokumpu direct-to-copper process, *M. KUCHARSKI, T. SAK, P. MADEJ, M. WĘDRYCHOWICZ and W. MRÓZ* 184
- 3) Physicochemical characterization of copper slag and alternatives of friendly environmental management, *Mario SÁNCHEZ, Michel SUDBURY* 185
- 4) Sustainability of technologies dealing with molten slag, fluxes and salts, *Florian KONGOLI, Edward Z. O'BRIE, S. Llubani and Ian McBow* 186
- 5) Thermodynamic predictions and experimental investigation of slag liquidus and minor element partitioning between slag and matte in support of the copper Isasmelt smelting process commissioning and optimisation at Kazzinc, *Hector M. HENAO, Leonid A. USHKOV and Evgueni JAK* 187
- 6) Reducing iron content in molten aluminum by super-gravity segregation, *Shitong SUN, Jingwei LI, Zhancheng GUO, Huiqing TANG and Zhi WANG* 189
- 7) The microstructure and composition of granulated platinum furnace slags, *Lesley ANDREWS and P. Chris PISTORIUS* 190
- 8) The formation of magnetite in slag from the autogenous smelting of sulphide copper-zinc concentrates, *Evgeniy SELIVANOV* 191
- 9) The use of QEMSCAN techniques to characterize entrained matte in platinum furnace slags, *Yolanda SCHARNECK and Lesley ANDREWS* 192
- 10) Activity of lead in copper matte at very low lead concentration, *Ty TRAN, Steven WRIGHT and Shouyi SUN* 193
- 11) Recovery of tellurium from sodium carbonate slag, *M. KUCHARSKI, P. MADEJ, M. WĘDRYCHOWICZ, T. SAK and W. MRÓZ* 194

Chapter 14 Molten Salts and Their Applications

- 1) Metal production by electrolysis in molten salts, *Geir Martin HAARBERG* 195
- 2) Current status of technologies for recycling rare earth metals, *Toru H. Okabe* 196
- 3) The kinetic pathway of decomposition of MgSiO_3 by alkali fusion using sodium hydroxide, *Qian XU, Min XU, Riqiang LIU, Zirui WANG and Yuchun ZHAI* 197
- 4) Systematics in the formation of lanthanide halide compounds, *Marcelle GAUNE-ESCARD, Leszek RYCERZ, Ewa INGIER-STOCKA and Slobodan GADZURIC* 198
- 5) Electrochemical formation of RE alloys (RE = Dy, Nd) in a molten LiCl-KCl system and separation of Dy, *Hirokazu KONISHI, Hideki ONO, Tetsuo OISHI and Toshiyuki NOHIRA* 199

6) Direct electrochemical reduction of titanium-bearing compounds to titanium-silicon alloys in molten calcium chloride, <i>Xingli ZOU and Xionggang LU</i>	200
7) Ytria stabilized zirconia membrane stability in molten fluoride fluxes for low-carbon magnesium production by the SOM process, <i>Jarrold MILSHTEIN, Eric GRATZ, Soobhankar PATI, Adam C. POWELL and Uday PAL</i>	202
8) Optimization of Salt Extraction Process through cyclic production and consumption of aluminium chloride by a novel anodic reaction, <i>Babak Khalaghi, Lidong Teng, Seshadri Seetharaman</i>	204
9) Study on functions of chrome and fluoride ions in plating process of tin free steel by means of cyclic voltammetry, <i>Jianzhong Li, Guofeng DU, Yanwen TIAN, Xiuli SUN and Shaohu TAO</i>	205
10) Thermal stability of potassium and sodium nitrate molten salt mixtures above 500°C, <i>Steven WRIGHT, Ty TRAN, Chunlin CHEN, Rene OLIVARES and Shouyi SUN</i>	206
11) An investigation of electro-deoxidation process for producing titanium from dense titanium dioxide cathode, <i>Zhiyuan CHEN, Kuochih CHOU and Fushen LI</i>	207
12) Influence of Nickle Additive on the Electro-reduction of SiO ₂ in Molten CaCl ₂ , <i>Han WANG, Sheng FANG, Juanyu YANG, Bing YU, Zhijun KANG and Haiyang DING</i>	208
13) Performance of CaCl ₂ in Molten Salt Electrolysis Process, <i>Zhanglong YU, Juanyu YANG, Ning WANG, Meng LI, Zhefeng GAO and Shigang LU</i>	209

Chapter 15 Recycle and Utilization of Slags and Industrial Wastes

1) Dry slag granulation-some interesting measurements and observations on molten slags, <i>Sharif JAHANSHAHI, Yuhua PAN and Dongsheng XIE</i>	210
2) The present situation and development in technology of iron and steel slag utilization with high-value addition, <i>Chun WANG, Jingling YANG, Guilin ZHU, Yidang HAO, Yu ZHANG and Shushan SUN</i>	211
3) Study on cementitious properties of steel slag, <i>Guilin ZHU, Yidang HAO, Chun XIA, Yibo ZHANG, Tianqi HU and Shushan SUN</i>	213
4) Recycling of the rare earth oxides from spent NiMH batteries using waste metallurgical slag, <i>Kai TANG, Arjan CIFTJA, Casper van der EIJK, Shawn WILSON and Gabriella TRANELL</i>	214
5) A novel green technique to recovery valued nonferrous-metal compounds from molten slags, <i>Nianxin FU, Zhitong SUI, Taiping LOU, Xinghong DU, Guanqiang LI and Houshong CHE</i>	215
6) Preparation of polymerization aluminium ferric chloride from bauxite tailings, <i>Dongyang MA, Min GUO and Mei ZHANG</i>	216
7) Synthesis of (Ca,Mg) α' -Sialon-AlN-BN powders from boron-rich blast furnace slag by microwave carbothermal reduction-nitridation, <i>Tao JIANG and Xiangxin XUE</i>	217
8) Fundamental research on a rational steelmaking slag recycling system by phosphorus separation and collection, <i>Kenji NAKASE, Akitoshi MATSUI, Naoki KIKUCHI Yuji MIKI, Yasuo KISHIMOTO, Itsuo</i>	

<i>GOTO and Tetsuya NAGASAKA</i>	219
9) The effects of cooling rate on leaching behaviour of some ferrous and non-ferrous slag systems <i>Sina MOSTAGHEL, Fredrik ENGSTRÖM, Qixing YANG, Caisa SAMUELSSON and Bo BJÖRKMAN</i>	221
10) Pilot experiences of Swerea MEFOS on slag recycling, <i>Guozhu YE and Mikael LINDVALL</i>	223
11) Leaching process investigation of secondary aluminum dross: the effect of CO ₂ on leaching process of salt cake and AlN hydrolysis behavior, <i>Peng LI, Min GUO, Mei ZHANG, Lidong TENG and Seshadri SEETHARAMANN</i>	224
12) Transformation of secondary steelmaking slags towards a hydraulic binder via controlled cooling and post-processing, <i>Y. PONTIKES, L. KRISOVA, D. GEYSEN, P. T. JONES, M. GUO, B. BLANPAIN</i>	225
13) Utilization of steelmaking slag at marine environment for coastal revegetation, <i>Xiaorui ZHANG, Hiroyuki MATSUURA and Fumitaka TSUKIHASHI</i>	226
14) Recycling of slag to act as rutile in E71T-1 type FCW, <i>Zhuoxin LI, Chuanwei SHI, Guodong LI and Jun JIAO</i>	227
15) The utilization of metallurgical slags by means of oxidation in the liquid state, <i>Anna SEMYKINA, Jinichiro NAKANA, Seetharaman SRIDHAR, Volodymyr Shatokha and Seshadri SEETHARAMAN</i>	228
16) Application practice of BOF slag tailings in steelmaking process, <i>Fuliang WANG, Chunxin WEI, Jun WANG, Lei ZHAO, Chao LI and Guoyi XU</i>	229