Light Metals 2015

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TABLE OF CONTENTS
Light Metals 2015

Preface xix
Editors/Organizers xxi
Committee Members xxiii

Alumina and Bauxite

Bauxite and Beneficiation

Theory and Practice of Bauxite X-Ray Sorting 5
V. Shemyakin, S. Skopov, G. Klimentenok, and A. Panov

Roasting Pretreatment of High-Sulfur Bauxite with Low-Median Grade in Chongqing China 11
J. Yin, M. Han, W. Yang, J. An, X. Zhou, W. Xia, and L. Huang

Improving Characterization of Low Grade Elburz Bauxite to Be Utilized in Jajarm Alumina Plant 15
M. Shadloo and M. Zarbayani

Bauxite Beneficiation Modifying Factors: A Case Study 21
C. van Deursen

Digestion

A Novel Self-Stirring Tubular Reactor Used in Bauxite Digestion Process 29
Z. Zhang, Q. Zhao, D. Zhang, T. Zhang, Y. Liu, G. Lv, Z. Dou, and C. Zhang

Study on the Prediction Model of Heat Transfer Coefficient during Tube Digestion 35
Z. Zhang, B. Zhang, and Z. Li

Research on Digestion Behavior of Sulfur in High-Sulfur Bauxite 39
Z. Liu, W. Li, W. Ma, Z. Yin, and G. Wu

The Impact of Sulphate and Carbonate on the Performance of Siliconate-Type Polymers as Inhibitor of Scaling 45
V. Kazakov and V. Lipin

Fuzzy Technology Application in a Bauxite Digestion Unit 49
T. Franco, R. Seno, A. Duck, L. Filho, and I. Santiago

Research of the Mineral Fouling Composition and Removal Method in Bauxite Digestion Process 55
C. Wenzhong, W. Dongdong, T. Weiwei, and Z. Hong

Synergistic Effect of $C_{12}A_7$ and CA on Alumina Leaching Property Under Low Calcium/Aluminum Ratio 59
B. Wang, J. Liu, H. Sun, Y. Zhang, and D. Liu

Precipitation and Calcination

CFD Simulations of a Large-Scale Seed Precipitation Tank Stirred with Multiple Intermig Impellers 65
G. Zhang, H. Zhao, C. Lv, Y. Liu, and T. Zhang

Recovering Waste-Heat and Water from Alumina Calciner Gas 69
Y. Liu, L. Li, X. Liao, and R. Bai

Smelter Grade Alumina Quality in 40+ Year Perspective: Where to from Here? 73
B. Raahauge

Alumina Calcination: A Mature Technology Under Review from Supplier Perspective 79
C. Klett and L. Perander

Numerical Simulation on Carbonation Reactor of Calcified Residue 85
L. Yan, L. Guanting, Z. Jun, L. Xiaolong, and Z. Tingan

Red Mud Disposal and Utilization

Improved Efficiency of Red Mud Processing through Scandium Oxide Recovery 93
O. Petrakova, A. Panov, S. Gorbachev, G. Klimentenok, A. Perestoronin, S. Vishnyakov, and V. Anashkin

Modern Technologies for Difficult to Filter Substances in Alumina Refinery 97
R. Seytenov and V. Lipin

Bauxite Beneficiation Reject Dewatering and Disposal 103
C. Deursen

Complex Additives on the Basis of Red Mud for Intensification of Iron-Ore Sintering and Pelletizing 107
G. Podgorodetskiy, V. Gorbunov, A. Panov, S. Petrov, and S. Gorbachev

Utilization of the Smartdiver to Improve Control of Settlers, Washers and Tailings Thickeners 113
P. Morgan, S. Morris, and N. Waugh

Alternative Raw Materials and Processes, Industrial Trends

Preparation of Zeolite 4A by Using High-Alumina Coal Fly Ash..... 121
Y. Shaoyong, Z. Ting'an, C. Chu, Z. Xianqi, S. Junmin, L. Guozhi, and Y. Huibin

Study of Filtration and Washing of Residue After HCL Leaching of Kaolin Clay 127
A. Senyuta, A. Panov, A. Damaskin, and A. Smirnov

Energy in Alumina Refining: Setting New Limits 131
A. Scarsella, S. Noack, E. Gasafi, C. Klett, and A. Koschnick

Sustainability and Alumina Refinery Design 137
P. ter Weer

Study on the Production of Ceramic Glass from Calcium-Silica Residue 143
H. Sun, H. Zhang, B. Wang, and S. Rong

Preparation of Pseudo-Boehmite by Using High-Alumina Coal Fly Ash..... 147
Z. Xianqi, Z. Ting'an, F. Wei, Y. Shaoyong, S. Junmin, L. Guozhi, and Y. Huibin

Aluminum Alloys: Development, Characterization, and Applications

Material Characterization

The Influence of Microchemistry and Processing Conditions on the Softening Behavior of Cold-Rolled Al-Mn-Fe-Si Alloys 157
K. Huang and K. Marthinsen

Effects of Zr and V Micro-Alloying on Activation Energy during Hot Deformation of 7150 Aluminum Alloys 163
C. Shi and X. Chen

Microstructure Evolution in Al-Mg Alloys during and after Hot Deformation 169
R. Perez-Bustamante, R. Rupp, A. Weldon, T. Watt, K. Takata, and E. Taleff

The Effect of Vanadium Addition on Structure and Material Properties of Heat Treated 6XXX Series Aluminium Alloys 173
M. Lech-Grega, W. Szymański, S. Boczkal, M. Gawlik, and M. Bigaj

Mechanical Properties of Al-(8, 10)%Zn-2%Mg-2%Cu Base Alloys Processed with High-Pressure Torsion 179
I. Aoi, S. Kuramoto, and K. Oh-ishi

Influence of Solution Heat Treatment Temperature in the Final Properties of AA6201 Drawn Wire 183
M. Iraizoz, N. Rossello, and M. Amado

Primary Crystallisation of Intermetallic Compounds in the Al-Ni-Fe-Mn-Si System in Relation to Foundry Alloys Based on an Aluminium-Nickel Eutectic 189
N. Belov, A. Alabin, I. Matveeva, and A. Sannikov

Development and Applications

Process Development for Stamping A-Pillar Covers with Aluminum 197
J. Choi, A. Rohatgi, M. Smith, and C. Lavender

Development of an Accelerated Ageing Test on an Al-Si-Cu-Mg Alloy for Aeronautics 203
L. Grosset, C. Desrayaud, A. Fraczkiewicz, C. Bosch, L. Anssems, B. Guérin, and S. Becquerelle

Mechanical and Thermal Properties of Rheocast Telecom Component Using Low Silicon Aluminium Alloy in As-Cast and Heat-Treated Conditions 209
M. Payandeh, E. Sjölander, A. Jarfors, and M. Wessen

Aluminum High Pressure Vacuum Die Casting Applications for the Multi Material Lightweight Vehicle Program (MMLV) Body Structure 215
R. Beals, J. Conklin, T. Skszek, M. Zaluzec, and D. Wagner

Warm Forming of AA7075-T6 with Direct Electrical Resistance Heating 223
T. Ivanoff, E. Taleff, and L. Hector

Influence of Heat Treatment Parameters on the Metallurgical Quality of EN AW 7068 Extruded Bars 229
M. Rosso, I. Peter, and C. Castella

Scrap-Intensive Wrought Aluminum Alloys of Standard Quality 237
V. Kevorkijan, P. Cvahte, B. Hmelak, S. Hmelak, V. Dragojević, M. Jelen, M. Lažeta, and U. Kovačec

Simulation and Modeling

Deformation and Failure of an Al-Mg Alloy Investigated Through Multiscale Microstructural Models 245
A. Magee and L. Ladani

Load/Displacement and Energy Dissipation Performances of Aluminum and Magnesium Extrusions Subjected to Quasi-Static and Dynamic Loading Under Axial Crush and Cutting Deformation Modes 251
R. Smith, P. Strausburger, W. Atlenhof, and E. Beeh

Estimation of Heat Transfer Coefficient in Squeeze Casting of Wrought Aluminum Alloy 7075 by the Polynomial Curve Fitting Method 257
X. Zhang, L. Fang, H. Hu, X. Nie, and J. Tjong

Casting and Solidification

Statistical and Thermodynamic Optimization of Trace-Element Modified Al-Mg-Si-Cu Alloys 265
S. Pogatscher, H. Antrekowitsch, M. Werinos, G. Rank, A. Kaiß, R. Prillhofer, J. Löffler, and P. Uggowitzer

The Influence of Cooling Rate and Alloying Elements on the Microstructure Refinement of Al-5Fe Alloy 271
Y. Liu, M. Liu, L. Luo, L. Zhang, Y. Zhao, J. Wang, and C. Liu

An Alternative Eutectic System for Casting Aluminum Alloys I. Casting Ability and Tensile Properties 277
T. Koutsoukis and M. Makhlouf

An Alternative Eutectic System for Casting Aluminum Alloys II. Modification of the Eutectic Morphology 283
T. Koutsoukis and M. Makhlouf

Role of Solidification Conditions in Determining the Microstructure of Al-Si Cast Alloys 289
A. Samuel, S. Alkahtani, K. Abuhasel, and F. Samuel

Microstructure and Tensile Data of a Very Ductile as Cast Al-21%Si-1.5% Ba Hyper-Eutectic Alloys 297
M. Shamsuzzoha

Grain Refinement Behavior of Al-Zn-Si Alloy by Inoculation in Hot-Dip Coating 301
W. Peng, G. Wu, X. Dai, J. Zhang, W. Hu, and K. Chou

Deformation and Texture

Evaluation of Forming Limit Diagram of Aluminum Alloy 6061-T6 at Ambient Temperature 309
M. Sharma and J. Mukhopadhyay

Characterizing and Modeling the Deformation of AA5182 for Hot Blank – Cold Die (HB-CD) Stamping 315
N. Zhang and F. Abu-Farha

The Portevin-Le Châtelier Effect in a Rheocast Al-Si-Cu Alloy 321
A. Jarfors, N. Andersson, T. Bogdanoff, M. Payandeh, S. Seifeddine, A. Leickt, and A. Tapper

High-Rate Formability of High-Strength Aluminum Alloys: A Study on Objectivity of Measured Strain and Strain Rate 327
P. Upadhyay, A. Rohatgi, E. Stephens, R. Davies, and D. Catalini

The Surface Necking Forming Mechanism in an AA6016 Automotive Sheet during Bending 333
Q. Zhang, P. Zhao, J. Liu, and Y. Feng

Advanced Analysis

Hydrogen Visualization in the Deformed Microstructure of Al-Zn-Mg Base Alloys 341
K. Horikawa, K. Tanigaki, and H. Kobayashi

Investigation of the Structural Stability of Nanostructured Al-5.7wt.%-Ni Mechanically Alloyed Eutectic Alloy Powders 347
M. Ragab and H. Salem

A Comprehensive Study on the Effect of Retrogression and Re-Aging on the Properties of Aluminium Alloy Conforming to AA 7049 Specification 353
B. Muralidhara and R. Ranganatha

Precipitation Behaviors

Effects of Different Temper and Aging Temperature on the Precipitation Behavior of Al 5xxx Alloy 361
G. Yi, D. Cullen, A. Derrick, Y. Zhu, and M. Free

Influence of Temperature on Natural Aging Kinetics of AA6061 Modified with Sn 367
M. Werinos, H. Antrekowitsch, W. Fragner, T. Ebner, P. Uggowitzer, and S. Pogatscher

Corrosion Resistance and Emerging Technologies

Use of Nano-Structured Silanols on the Solidification of Aluminum-Silicon Based Casting Alloys 375
A. Lee, Y. Lu, A. Roche, and T. Pan

Poster Session

Study on Inhibitors of Copper and Copper-Nickel Alloy in LiBr Solution 381
X. Hu

The Influence of Alloying Additions on Interaction of Aluminum Alloys with Aqueous Media 387
A. Baimakov, S. Petrovich, V. Lipin, A. Shahmin, and R. Seytenov

Effect of Titanium on Dross Formation in Hot-Dip 55%Al-Zn-Si-La Bath 393
Q. Li, Q. Li, and K. Chou

Nickel Coatings with Submicrometric Hard Ceramic Particles on Aluminum Alloys 397
M. Nowak, A. Kozik, M. Karaś, S. Boczkal, and M. Gawlik

The Effect of Cooling Rate and Cerium Melt Treatment on Thermal Analysis Parameters and Microstructure of Hypoeutectic Al-Si Alloy 403
V. Vijayan and K. Prabhu

Aluminum Processing

Session I

Prioritizing Water Contaminants' Impact on Heat Transfer in Casting Aluminum Ingots 413
R. Baxter, J. Gast, and S. Wood

Optimization of Isothermal Hot Rolling Parameters Using ANSYS and LS-DYNA 419
C. Mansfield and A. Gordon

Direct Flame Impingement: A New Oxy-Fuel Based Technology for Continuous Annealing of Aluminium Strip 423
H. Gripenberg and R. Eichler

Aluminum Surface Texturing by Means of Laser Interference Metallurgy 427
J. Chen, A. Sabau, J. Jones, A. Hackett, C. Daniel, and D. Warren

Novelis High-Speed Can End Coating Line – Operational Results 431
A. Tropeano and T. Neto

Session II

Theoretical and Experimental Studies of a Thermal Regenerator for Heat Recovery in Aluminium Melting Furnaces 439
H. Ajdari and S. Sadrameli

Strain Analysis during the Symmetric and Asymmetric Rolling of 7075 Al Alloy Sheets 445
C. Ma, L. Hou, J. Zhang, and L. Zhuang

Results in Production of an Improved Grain Refinement Practise for 6XXX Extrusion Billets 451
J. Courtenay, R. Vainik, and M. Rosefort

Structural Studies on the Evolution of Texture in Heavily Wire Drawn and Subsequently Annealed Pure Al Metal 457
M. Shamsuzzoha

Use of Vaporizing Foil Actuator for Impact Welding of Aluminum Alloy Sheets with Steel and Magnesium Alloys 463
B. Liu, A. Vivek, and G. Daehn

Microstructure Evolution of AA3003 Aluminum Alloys Enhanced by Zirconium Addition Studied by Electron Microscopy 469
M. Poková, M. Zimina, and M. Cieslar

Aluminum Reduction Technology

Cell Technologies and Design

Simulation and Measurements on the Flow Field of 600kA Aluminum Reduction Pot 479
W. Liu, D. Zhou, Y. Liu, M. Liu, and X. Yang

CHINALCO 600kA High Capacity Low Energy Consumption Reduction Cell Development 483
D. Zhou, X. Yang, M. Liu, and W. Liu

Development History and Performance of Dubal DX+ Demonstration Cells 489
A. Zarouni, A. Zarouni, N. Ahli, S. Akhmetov, M. Reverdy, M. Hussain, K. Nikandrov, and L. Mishra

Arvida Aluminum Smelter - AP60 Technological Center, Start-Up Performance and Development of the Technology 495
M. Forté, M. Robitaille, N. Gros, R. Gariepy, I. Mantha, L. Lefrançois, and J. Figue

From D18 to D18+: Progression of Dubal's Original Potlines 499
D. Whitfield, S. Akhmetov, M. Al-Jallaf, J. Blasques, K. Al-Aswad, and I. Baggash

World's Longest Potline Start-Up at EMAL 505
W. Alsayed, A. Riyami, M. Hammadi, I. Ali, V. Pillai, A. Zarouni, A. Sergey, M. Reverdy, and N. Ahli

Technology Research on Aluminum Reduction Cell Pre-Stressed Shell 511
P. Zheng and W. Wang

Investment Advantages of the Establishing of Aluminium Clusters 517
S. Akhmedov and V. Kozlov

Environment I

Use of the Life Cycle Assessment Methodology to Support Sustainable Aluminum Production and Technology Developments 523
G. Girault, S. Petit, J. Rheault, D. Mercereau, and B. Verzat

Comparative Analysis of the Environmental Impacts of Aluminum Smelting Technologies 529
V. Kovács and L. Kiss

Variability Analysis of Total Fluoride Concentrations from Two Reduction Cell Technologies in a Primary Aluminum Smelter 535
M. Punta, J. Lifschitz, and J. Zavatti

Anode Effect Reduction at Nordural – Practical Points 539
A. Thorhallsson

Studies on Background PFC Emission in Hall-Héroult Reduction Cells Using Online Anode Current Signals 545
A. Jassim, S. Akhmetov, B. Welch, M. Skyllas-Kazacos, J. Bao, and Y. Yao

Non Anode Effect PFCS: Measurement Considerations and Potential Impacts 551
N. Dando, N. Menegazzo, L. Espinoza-Nava, N. Westendorf, and E. Batista

Fundamentals Chemistry

Effect of Operational Parameters on the Behavior of Phosphorus and Sulfur in Aluminum Reduction 559
R. Meirbekova, G. Haarberg, J. Thonstad, D. Ziegler, J. Brynjarsson, and G. Saevarsdottir

Chemical Characterization and Thermodynamic Investigation of Anode Crust Used in Aluminum Electrolysis Cells 565
F. Allard, M. Désilets, M. LeBreux, and A. Blais

Non-Intrusive Freeze Layer Detection Method in an Aluminum Reduction Cell 571
Á. Ugron, L. Kiss, J. Bilodeau, and S. Guérard

Monitoring Local Alumina Dissolution in Aluminum Reduction Cells Using State Estimation 577
Y. Yao, C. Cheung, J. Bao, and M. Skyllas-Kazacos

Study on the Dissolution of Alumina in Cryolite Electrolyte Using the See-Through Cell 583
Y. Yang, B. Gao, Z. Wang, Z. Shi, and X. Hu

Production of Al-Sc Alloy by Electrolysis of Cryolite-Scandium Oxide Melts 589
Y. Shtefanyuk, V. Mann, V. Pingin, D. Vinogradov, Y. Zaikov, O. Tkacheva, A. Nikolaev, and A. Suzdaltsev

Environment II

Horizontal In-Duct Scrubbing of Sulfur-Dioxide from Flue Gas Exhausts 597
R. Ghosh, J. Smith, and A. Adams

Impact of Potroom Work Practices on Roofline Fluoride Emissions and Wet Scrubber Efficiency 603
N. Dando, W. Xu, and O. Fisher

Mobile Monitoring System for Potroom Roof HF Emissions 607
F. Potvin

Impact of Operational Practices and Cell Hooding on Total Fluoride Emissions in the Aluminium Smelter Plant of Aluar 613
M. Punta, J. Lifschitz, and J. Zavatti

Solution to Reduce Fluoride Emissions from Anode Butts 617
G. Girault, B. Petitjean, and G. Riverin

Start-Up of the Ozeos Gas Treatment Center (GTC) for RTA AP60 623
P. Martineau, J. Maltais, V. Vérin, and M. Frainais

Treatment of Gas Emissions in Potrooms 627
B. Hureiki, A. Periers, A. de Gromard, C. Lim, G. Dobra, and M. Cilianu

Possible Use of 25 MW Thermal Energy Recovered from the Potgas at Alba Line 4 631
A. Sørhuus, S. Ose, and B. Nilsen

Fundamentals Chemistry II

Behavior of Powders on the Surface of a Liquid 639
C. Kaszás, L. Kiss, S. Guérard, and J. Bilodeau

Development of a Mechanized Bath Sampling Method 643
A. Molin, L. Kiss, S. Poncsák, J. Bilodeau, and S. Guérard

Impact of Variable Bath Chemistry and Wetting on Gas Bubble Flow in Aluminium Electrolysis Cells 649
K. Einarsrud, I. Eick, P. Witt, A. Solheim, and Y. Feng

Study of the Structure and Thermophysical Properties of the Side Ledge in Hall-Héroult Cells Operating with Modified Bath Composition 655
S. Poncsák, L. Kiss, A. Belley, S. Guérard, and J. Bilodeau

The Performance of Aluminium Electrolysis in Cryolite Based Electrolytes Containing LiF, KF and MgF_2 661
P. Cui, A. Solheim, and G. Haarberg

Wetting Between Carbon and Cryolitic Melts. Part I: Theory and Equipment 665
A. Martinez, O. Paulsen, A. Solheim, H. Gudbrandsen, and I. Eick

Wetting Between Carbon and Cryolitic Melts. Part II: Effect of Bath Properties and Polarisation 671
A. Solheim, H. Gudbrandsen, A. Martinez, K. Einarsrud, and I. Eick

Materials and Equipment

External Potshell Insulation: A Multi-Usage Tool in Low Power Operation 679
P. Reny, M. Segatz, I. Eick, K. Mirek-Sliwa, O. Midtun, and J. Jørgensen

In-Depth Analysis of Lining Designs for Several 420 kA Electrolytic Cells 685
Z. Jianfei and M. Dupuis

Energy Savings Using a Different Anode Rod Design 691
I. Sousa, S. Matos, L. Paulino, J. Araújo, E. Costa, F. Costa, and W. Santos

New ECL Embedded Service Robot: Towards an Automated, Efficient and Green Smelter 695
J. Guérin and A. Hequet

An Innovative Pot Ramming Machine 699
P. Côté and G.Pucella

Primary Aluminium Production: Is Automation the Key to New Success? 705
M. Meijer

Bath Treatment Plant Process and Technology Trends 709
C. Bouché, R. Daligaux, H. Hite-Pratt, and A. Pinoncely

Standard Development Work in ISO Technical Committee 226 "Materials for the Production of Primary Aluminium" 715
R. Brown, J. Fischer, X. Xue, L. Wu, A. Schnittker, N. Turner, H. Øye, and L. Lossius

Operations and Energy Consumption

On-Line Monitoring of Individual Anode Currents to Understand and Improve the Process Control at Alouette 723
L. Dion, C. Lagacé, J. Evans, R. Victor, and L. Kiss

High Frequency Measurements of Current Through Individual Anodes: Some Results from Measurement Campaigns at Hydro 729
S. Kolås, P. McIntosh, and A. Solheim

Frequency Response Analysis of Electrolysis Cell Voltage Signals during the Alumina Feed Cycles 735
L. Azevedo, N. Nagem, and J. Neto

Experiments on Measurement of Online Anode Currents at Anode Beam in Aluminum Reduction Cells 741
J. Li, S. Yang, Z. Zou, and H. Zhang

Investigation of Cathode & Collector Bar Modification on Thermal Balance of a Low Amperage Cell 747
A. Gupta, S. Modak, M. Sahoo, and J. Janardhanan

Trading Current or Resistance for Metal Depth to Maintain Ledge 753
R. Beeler

Reduction in Power Consumption at UC RUSAL's Smelters 2012–2014 757
V. Mann, V. Buzunov, N. Pitertsev, V. Chesnyak, and P. Polyakov

Aspects of Change Management and Process Management at Some Smelters 763
Y. Gao, M. Taylor, J. Chen, and A. Mulder

Modelling

3D Coupled MHD and Thermo-Electrical Modelling Applied to AP Technology Pots 771
S. Langlois, J. Rappaz, O. Martin, Y. Caratini, M. Flueck, A. Masserey, and G. Steiner

A Model Based Study of Cell Electrical Preheating Practices at DUBAL 777
A. Arkhipov, A. Zarouni, S. Akhmetov, L. Mishra, and A. Jasmi

Mathematical Modelling of Hall-Héroult Pot Instability and Verification by Measurements of Anode Current Distribution 783
V. Bojarevics and J. Evans

Bubble Flow in a Static Magnetic Field 789
S. Das, L. Weerasiri, and V. Jegatheesan

The Impact of Bubble-Bubble Interaction on Anodic Gas Release: A Water Model Analysis 795
A. Simonsen, K. Einarsrud, and I. Eick

Observation of Anodic Bubble Behaviors Using Laboratory Scale Transparent Aluminium Electrolysis Cells 801
Z. Zhao, Z. Wang, B. Gao, Y. Feng, Z. Shi, and X. Hu

Impact of Copper Inserts in Collector Bars 807
R. von Kaenel, J. Antille, and L. Bugnion

Joint Session on Electrodes and Operations (with Electrode Technology)

In-Situ Formation of Slots in Søderberg Anodes 815
A. Tabereaux and X. Wang

Non-Linear Stability Analysis of Cells Having Different Types of Cathode Surface Geometry 821
M. Dupuis and V. Bojarevics

The Influence of Cathode Shape on Current Density and Metal Heave in 300 kA Aluminum Reduction Cell 827
Y. Song, N. Feng, J. Peng, B. Li, and Q. Wang

Detailed Model of Electrochemical Cathode Wear in Hall-Héroult Cells 831
T. Li, S. Johansen, and A. Solheim

Electroslag Welding (ESW): A New Option for Smelters to Weld Aluminum Bus Bars 837
B. Leroux

The Resistibility of Semi-Graphitic Cathode to Alkali Metal (K and Na) Penetration 843
Z. Fang, H. Kong, L. Li, and T. Hong

The Status and Development Trends of Carbon Cathode Materials in China 849
S. Zhang, Z. Zhao, and B. Chen

Cast Shop for Aluminum Production

Direct Chill Casting

On Liquid Metal Wetting of Casting Rings for DC Casting 859
N. Bayat and T. Carlberg

Thermal Stress Prediction in AA5182 Rectangular Ingots 865
Y. Wang, M. Krane, and K. Trumble

Macrosegregation during Direct Chill Casting of Aluminum Alloy 7050 871
K. Fezi, J. Coleman, and M. Krane

Experimental Observations of Macrosegregation in DC Casting of Rolling Slab Ingots 877
S. Wagstaff and A. Allanore

Development and Demonstration of a Flexible Ingot Mould Filling System 883
J. Desmeules

Furnaces and Energy Efficiency

Developing a Do-It-Yourself Excel Model of a Reverberatory Side-Well Aluminum Melting Furnace 889
A. Morris

Numerical Modeling of Heat Transfer in a Full Scale Industry Furnace 895
J. Furu and A. Buchholz

Rotary Flux Injector (RFI): Recent Development Towards an Autonomous Technology 901
F. Breton, A. Larouche, P. Waite, and P. Côté

Truths and Falsehoods of Molten Metal Explosions in the Aluminium Industry 905
A. Lowery

Calculated Aluminum Oxidation Rates during Rotary Furnace Melting Through Flue Gas Analysis 909
S. Jepson

CFD Comparison of Immersed Heater and Open Fire Burner Designs for Casting Furnaces 915
M. Hassan and A. Brimmo

Metal Treatment, Alloying, and Grain Refinement

Recent Progress with Development of a Multi Stage Filtration System Employing a Cyclone 923
J. Courtenay, R. Vainik, G. Esposito, and M. Rosefort

Effect of Electromagnetic Fields on the Priming of High Grade Ceramic Foam Filters (CFF) with Liquid Aluminum 929
R. Fritzsch, M. Kennedy, S. Akbarnejad, and R. Aune

Practical Use of the MetalVision Ultrasonic Inclusion Analyzer 937
D. Smith, B.Hixson, H. Mountford, and I. Sommerville

Ultrasonic Degasing and Processing of Aluminum Part II 943
V. Rundquist, K. Manchiraju, and Q. Han

An Investigation on Permeability of Ceramic Foam Filters (CFF) 949
S. Akbarnejad, M. Kennedy, R. Fritzsch, and R. Aune

Assessment of Modification Level in EN AC-46000 Aluminum Casting Alloys Using Thermal Analysis and Microscopic Evaluation 955
M. Zamani and S. Seifeddine

A New Kind of Al-5Ti-0.3C Master Alloy and Its Refining Performance on 6063 Alloy 961
E. Wang, S. Liu, J. Nie, T. Gao, T. Wang, and X. Liu

Metal Quality

Study of Particle Settling and Sedimentation in a Crucible Furnace 967
M. Badowski, M. Gökelma, J. Morscheiser, T. Dang, P. Le Brun, and S. Tewes

Improvements in LiMCA Technology: Introducing the LiMCA III 973
T. Buijs, D. Gagnon, and C. Dupuis

Molten Metal Treatment Improvements at JW Aluminum Used as a Method to Guarantee Metal Quality 979
C. Dube, D. Smith, and B. Hixson

The Influence of Melt Charge Materials on Molten Metal Quality at JW Aluminum 983
B. Hixson, C. Dube, and D. Smith

SiC Particle Detection in Liquid Aluminum via Laser Induced Breakdown Spectroscopy 987
S. Hudson, J. Craparo, R. De Saro, and D. Apelian

Development of a LiMCA Methodology for the Measurement of Inclusions at Different Depths in Molten Aluminium 991
P. Le Brun and F. Taina

General Cast Shop

Deformation of the Aluminum Bath Surface in an Induction Melting Furnace 999
A. Bansal, P. Chapelle, Y. Delannoy, E. Waz, P. Le Brun, and J. Bellot

History and Future of Dross Processing 1005
D. Roth

Recycling of Aluminum A380 Machining Chips 1011
B. Xiong, X. Zhang, F. Li, H. Hu, and C. Liu

Production and Certification of Metallic Certified Reference Materials for the Analysis of Aluminium Alloys 1017
H. Hamouche, J. Archambault, and C. Dupuis

Recycling of Automotive Wrought Alloys 1023
R. Peterson

Electrode Technology for Aluminum Production

Anode Raw Materials

Pilot Anode Testing of Alternative Binder and CPC Raw Materials 1033
W. Boenigk, C. Boltersdorf, C. Kuhnt, J. Stiegert, L. Edwards, and M. Lubin

Calcined Petroleum Coke Density Separation Process: Solution to Maintain Anode Quality with Degrading Coke Density 1039
M. Dion, C. Gaudreault, and Y. Ménard

New Developments of Anode Coke Grinding Using a Vertical Mill Technology 1045
H. Nolde, J. Paepcke, J. Thiel, and A. Hilck

Effects of Mixing Parameters and Pores of Cokes on Pitch Absorption in Making Carbon Anode Pastes 1049
T. Chen, J. Xue, X. Li, G. Lang, G. Zhou, and L. Tang

Real-Time Measurement of Coke Aggregate Size and Vibrated Bulk Density Using Image Texture Analysis 1055
W. Bogoya-Forero, C. Duchesne, and J. Tessier

Anode Aggregate Bulk Density Determinations Using a Y-Blender 1061
D. Belitskus

A Size-Dependent Thermodynamic Model for the Carbon/Hydrogen/Sulfur System in Coke Crystallites: Application to the Production of Pre-Baked Carbon Anodes 1067
P. Ouzilleau, A. Gheribi, and P. Chartrand

Traceability of Raw Materials in Silos in an Anode Plant 1073
D. Bhattacharyay, D. Kocaefe, Y. Kocaefe, B. Morais, and J. Lafrance

Anode Forming and Baking

A Dynamic Process Model for Predicting the Performance of Horizontal Anode Baking Furnaces 1081
N. Oumarou, Y. Kocaefe, D. Kocaefe, B. Morais, and J. Lafrance

Environmental and Operating Benefits of a New Fume Treatment System at a Restarted Anode Plant 1087
M. Hagen, B. Schricker, and P. Deinlein

Successful Start-Up of Firing Control System at Vlissingen 1093
N. Fiot, P. Mahieu, and B. van Garsel

Quality Control via Electrical Resistivity Measurement of Industrial Anodes 1097
Y. Kocaefe, D. Kocaefe, and D. Bhattacharyay

Xelios Vibrocompactors Performance and Reliability 1103
V. Philippaux, J. André, and B. Somnard

Baking Furnace Rebuild Strategy at DUBAL to Improve Productivity 1109
P. Palavar, T. Sahu, A. Marzouqi, S. Rabba, G. Priyantha, and T. Aiyaz

Description and Applications of a 3D Mathematical Model for Horizontal Anode Baking Furnaces 1115
M. Baiteche, D. Kocaefe, Y. Kocaefe, D. Marceau, B. Morais, and J. Lafrance

Anode Properties

Evaluating the Crack Resistance of Carbon Anodes - Implementation of a Measurement System for Tensile Strength and Fracture Toughness 1123
D. Andersen and H. Linga

Comparison of Linear Multivariable, Partial Least Square Regression, and Artificial Neural Network Analyses to Study the Effect of Different Parameters on Anode Properties 1129
D. Bhattacharyay, D. Kocaefe, Y. Kocaefe, B. Morais

Factors Influencing Baked Anode Properties 1135
K. Khaji and M. Qassemi

Spatial Methods for Characterising Carbon Anodes for Aluminium Production 1141
C. Sommerseth, R. Thorne, S. Rørvik, E. Sandnes, A. Ratvik, L. Lossius, H. Linga, and A. Svensson

Air and CO_2 Reactivity of Carbon Anode and Its Constituents: An Attempt to Understand Dusting Phenomenon 1147
F. Chevarin, L. Lemieux, D. Ziegler, M. Fafard, and H. Alamdari

Effects of Coke Types and Calcining Levels on the Properties of Bench-Scale Anodes 1153
N. Fang, J. Xue, X. Li, G. Lang, C. Bao, S. Gao, B. Xia, and J. Jiang

Effects of Current Density and Temperature on Anode Carbon Consumption in Aluminum Electrolysis 1157
L. Feng, J. Xue, G. Ndong, X. Li, G. Lang, R. Lin, W. Li, and X. Xu

Anode Rodding and Inert Anodes

Anode Stub 3D Inspection System 1165
P. Côté, J. Gagné, R. Minville, R. St-Pierre, and H. Frenette

Determination of the Microstructural Creep Properties of Cast Iron Connector at High Temperatures for the Prediction of the Thermo-Mechanical Behavior of Anodic Assemblies 1169
D. Lukovnikov, D. Racine, D. Marceau, R. Zhelateleva, D. Balloy, and D. Laroche

Development of a New Approach to Increase the Electrical Performance of Anodic Assemblies 1175
S. Tremblay, D. Marceau, D. Kocaefe, and C. Lagacé

On the Evolution of Steel Stub Thermo-Physical and Thermo-Mechanical Properties during Operational Stage of Anodic Assemblies 1181
D. Lukovnikov, D. Racine, R. Zhelateleva, D. Marceau, L. Kiss, D. Balloy, and D. Laroche

Influence of Partial Substitution of Cu by Various Elements in Cu-Ni-Fe Alloys on Their High-Temperature Oxidation Behavior 1187
E. Gavrilova, G. Goupil, B. Davis, D. Guay, and L. Roué

Study on the Bubble Behavior and Anodic Overvoltage of $NiFe_2O_4$ Ceramic Based Inert Anodes 1193
J. Du, B. Wang, Y. Liu, G. Yao, Z. Fang, and P. Hu

Application of Grey Relational Analysis for Corrosion Rates of Inert Anodes in Aluminum Electrolysis 1199
Q. Qin, Y. Xu, J. Yang, and X. Zheng

Strip Casting of Light Metals

Process Technology

The Importance of Heat Removal for Productivity in Industrial Twin Roll Casting of Aluminium 1209
C. Schmidt, A. Buchholz, and K. Karhausen

A Single Roll Caster Equipped with a Scraper 1215
T. Haga

Effect of Casting Parameters on Microstructure, Recrystallization Behaviour and Final Material Properties of Twin-Roll Cast 1050 Alloy 1219
C. Işıksaçan, O. Meydanoğlu, V. Akdoğan, G. Alper, and B. Beyhan

Comparison of Twin-Roll Casting and High-Temperature Roll Bonding for Steel-Clad Aluminum Strip Production 1225
O. Grydin, M. Schaper, and M. Stolbchenko

Casting of Clad Strip by a Twin Roll Caster 1231
T. Haga

High Strength Aluminum Alloy Sheets Fabricated by Twin Roll Casting for Automobile Application 1235
H. Kim, Y. Lee, M. Kim, and C. Lim

Modeling and Properties

Modelling of the Twin Roll Casting Process Including Friction 1243
D. Mortensen, H. Fjær, D. Lindholm, K. Karhausen, and J. Kvalevåg

Effect of Cu Addition on the Microstructural Constituents and Mechanical Properties of Twin Roll Cast AlFeMnSi Alloys 1249
O. Meydanoglu, O. Birbaşar, A. Ulus, B. Beyhan, and E. Kalay

Improvement of Corrosion Resistance in Modified 3003 Aluminum Alloys Produced by Twin Roll Casting under Different Casting Parameters 1255
M. Günyüz, H. Altuner, and A. Ulus

Author Index 1260

Subject Index 1266

PREFACE

It is my great pleasure to present the *Light Metals 2015* proceedings, and a very special honour to be the first woman to edit this esteemed volume. Although women are still under-represented in the light metals industry, there are a number of notable women who have made major contributions—Jacynthe Côté, first female CEO of a major aluminium company, Najeeba Al Jabri who has led in the start-up of the world's largest potline, and Hilde Marete Aasheim to mention a few. Indeed the cultural and gender diversity of the light metals community has expanded notably since I attended my first TMS conference in the early 1990s.

These proceedings are the distillation of a huge effort on behalf of the global aluminium research community. TMS annual meetings represent a unique opportunity for the global aluminium community to share knowledge and experience. Through these proceedings, the accumulated knowledge is made accessible to others in the years to come. This knowledge transfer, from researcher to researcher, but more critically from researcher to practitioner is more important than ever, given the challenges that face our industry, such as energy consumption, raw materials quality and, in some parts of the world, attracting and retaining a skilled workforce.

New step-change approaches to smelting are the subject of this year's plenary session "Latest Developments in the Smelting of Light Metals." This joint session covers the major light metals—aluminum, magnesium, and titanium. This multi-metal approach allows us to look outside of our own technologies and explore how solutions being developed for other metals can be translated across to ours.

This translation—across industries, technologies and from researcher to practitioner can only occur when the lines of communication are open and parties on both sides of the conversation are receptive. An unfortunate consequence of the economic crisis is the increasing segregation between the research providers—now usually university-based—and the practitioners. Participation at the TMS conference by wide representation across all players in the industry—plant staff, research centre staff, academics, suppliers, and others is more important now than ever.

The production of these proceedings owes a great deal to the efforts of the Subject Chairs: Pete Forakis, John Griffin, Zhengdong Long, Arne P. Ratvik, Hans Werner Schmidt, Pascal Lavoie (and before him, Gary Tarcy) who have put in many hours to ensure that the quality and quantity of papers is as high as ever. I thank them for the time and energy they have volunteered. Behind the scenes, TMS staff has work tirelessly shepherding us through all stages of the production of these proceedings from the call for abstracts to the arranging of session timings. One of the fine *Light Metals* traditions is the mentoring and support of the editor by those who have gone before. I am grateful for the wise advice I received from John Grandfield and Barry Sadler.

Margaret Hyland
Editor, *Light Metals 2015*

EDITOR'S BIOGRAPHY

MARGARET HYLAND
LIGHT METALS 2015 EDITOR

Margaret Hyland is a professor in the Department of Chemical and Materials Engineering, University of Auckland; Deputy Dean of the Faculty of Engineering; and a principal investigator in the Light Metals Research Centre. She has a Ph.D. in Chemistry from the University of Western Ontario.

Margaret has been active in aluminum reduction technology, working with international aluminum producers and industry suppliers for more than 20 years. She has gained international recognition for her pioneering work in environmental aspects of aluminum reduction technology and materials performance. She is an authority on the generation and capture of fluoride and particulate emissions from aluminum smelters.

Margaret has contributed to the training of professionals in the aluminum industry through the delivery of specialist courses at TMS, and through the supervision of more than 40 engineering Ph.Ds and Masters graduates. She and her colleagues in the Light Metals Research Centre established the successful Postgraduate Certificate and Masters programs in Light Metals Reduction Technology, which is now entering its tenth year.

She was elected a Fellow of the Institute of Chemical Engineers (UK) in 2008. She has authored more than 120 refereed publications and 100 technical reports. She and her co-authors are five-time awardees of TMS Light Metals and Carbon Awards.

PROGRAM ORGANIZERS

ALUMINA AND BAUXITE

Hans Werner Schmidt has been involved in the alumina industry for more than 30 years. He graduated from the Technical University in Darmstadt with a diploma in mechanical engineering. In the same year he joined the R&D section of Lurgi GmbH in Frankfurt where he was particularly concerned with fluid bed technology, high temperature reactions, and combustion. He also worked at the Institute of Combustion, High Temperature and Flame Research in the Technical University of Karlsruhe and was promoted to Dr.-Ing. for Chemical Engineering at the University of Karlsruhe. He has served at Lurgi as process engineer, project manager, and head of the Department for Alumina Technology. He contributed with this department to a large number of new developments such as the Circulating Fluid Bed (CFB) Technology for alumina calcination and other applications in the chemical industry. He introduced the CFB Calciners to the alumina industry starting with the first industrial unit at Lunen Germany and continued with the implementation of many more calciners to various alumina producers worldwide. He has also participated in many new developments in the alumina industry such as a Dry Gas Cleaning process for aluminum smelters, the treatment of spent pot lining from aluminum smelters and the tube digester technology for the Bayer process. The first power plant based on coal combustion in the Circulating Fluid Bed was also built under his responsibility. This power plant unit supplied energy for the alumina refinery and heat for the tube digester at the same refinery. Dr. Schmidt has published several papers in TMS *Light Metals*, ICSOBA, AQW/Australia and international conferences. In Outotec, who overtook Lurgi in 2001, he continued his activities in alumina technologies. After his retirement, he now works mainly for Outotec as Consultant for light metals, alumina technology, and fluidized bed engineering.

ALUMINUM ALLOYS: DEVELOPMENT, CHARACTERIZATION AND APPLICATIONS

Zhengdong Long is Senior Alloy Development Engineer at Kaiser Aluminum in Spokane, Washington, United States. Dr. Long has a Ph.D. in Material Science and Engineering from China Central Iron and Steel Research and Institute in Beijing, and MBA from University of Kentucky in Lexington, Kentucky, USA. Dr. Long has been active for over a decade in the areas of physical and mechanical metallurgies of aluminum alloys and superalloys. Dr. Long's diverse experience includes new alloys and products development and applications, process development and optimization, product integration and quality improvement, and project management. His expertise and interests are casting and thermo-mechanical processing, static and dynamic material properties, corrosion behaviors, advanced material characterization, as well as material and process modeling. He has numerous publications and patents.

ALUMINUM PROCESSING

John Griffin is Director of Aluminum Casting Technologies LLC, providing engineering consulting and manufacturing for operations and field/ metallurgical process in the international aluminum industry. He has a proven consistent track record in technical sales and marketing of technologies and new engineered products to the light metals industry. He has a BSME from New York University, an MSME from New Jersey Institute of Technology, and an MSMS from Fairleigh Dickerson University. In addition, he is a licensed P.E. in New Jersey and a Licensed General Contractor in Tennessee. John has over 30 years' experience in light metals product development and technology in primary, secondary, continuous casting, foundries and cast house processes, finishing mills and casting and rolling equipment. He has worked for Union Carbide Corporation, Hydro Aluminum, Pechiney Aluminum and Alcan and has been doing technical and marketing business in 60 countries. He has been Manager/ Director of turnkey E&C projects for clients including Norandal's "Quantum Leap" project and Kavaerner and Middough Engineering. He has gained global expertise from all major suppliers (SNIF, Hycast, Alpur and ACD technologies) of in-line degassing and filters (BA Filters, Deep Bed) and technologies. He holds two patents and has published and presented papers in more than 14 countries including six for TMS. He has been an active member of TMS since 1983 and was one of the first contributors to launch the TMS exhibit in 1983.

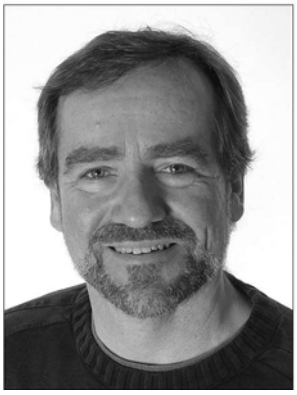
ALUMINUM REDUCTION TECHNOLOGY

Pascal Lavoie obtained his bachelor's degree in Materials and Metallurgical Engineering from Université Laval, Québec. He joined Noranda's Magnola magnesium smelter as process engineer. When Magnola was curtailed, he moved to Noranda New Madrid smelter as metallurgical process engineer and obtained a black belt certification. In 2006, Pascal joined the Light Metals Research Centre of the University of Auckland as Manager – International projects. He led a team conducting more than 40 industrially based R&D projects. Since 2011, Pascal has been Chief Engineer of the Centre. Now a consultant based in Canada, he provides technical support to smelting operations and reduction technologies. In 2006, he received the TMS Light Metals Division Young Leader award and has been on the LMD council and various committees since.

CAST SHOP FOR ALUMINUM PRODUCTION

Pete Forakis is an experienced professional in the cast houses. He has worked in operations, engineering, technical services, and consulting at various top-tier metal companies as well as engineering and consulting. This includes: Reynolds Metals Company (now Alcoa), Noranda (now Glencore), Rio Tinto Alcan, Hatch, and Emirates Aluminium. This has brought him to work in multiple places around the world including Canada, the United States, Australia, and the United Arab Emirates. He now works as the Regional Director for STAS, the aluminium equipment providers in the Middle East.

ELECTRODE TECHNOLOGIES



Arne P. Ratvik is a senior scientist at SINTEF Materials and Chemistry, Department of Electrolysis and High Temperature Materials in Trondheim, Norway. He gained his M.Sc. and Ph.D. in inorganic chemistry from NTNU (the Norwegian University of Science and Technology) followed by a post-doctoral period at the University of Tennessee; all related to molten salt systems and electrolytic production of light metals. He has industrial research and production management experience from Elkem and Falconbridge Nikkelverk (currently Glencore Nikkelverk) followed by several positions in SINTEF (Research Director, Research Manager and Sr. Scientist). He also had a four-year term as Head of Department of Materials Science and Engineering at NTNU. Current research interests are mainly within aluminum electrolysis with emphasis on materials chemistry and electrochemical performance of carbon anodes and cathodes, besides having experience from ferro-alloy and silicon pyrometallurgical processes and metal electrowinning in aqueous solutions. He has been project manager of several large primary aluminum related projects and has co-authored more than 30 papers.

STRIP CASTING OF LIGHT METALS

Kai F. Karhausen is department manager for process technology at the central Rolled Products R&D of Hydro Aluminium in Bonn, Germany. Dr. Karhausen earned his doctorate at the RWTH Aachen and worked in the industrial aluminum research for 18 years both in Norway and Germany. His principal work is focused on the modeling and optimization of materials behavior in industrial production processes. Dr. Karhausen has issued 75 scientific presentations and publications. In 2003 he was awarded the Georg-Sachs-Preis of the German Materials Society (DGM) for important achievements in the field of integrated modeling of metal forming and materials behavior. He served as chair of the Aluminum Processing Committee of TMS for five years.

Murat Dündar holds the position of Director of Technology in Assan Aluminum. He joined Assan Aluminum in May 1999 as a research specialist. He has primarily focused on performance improvement of aluminum foil and sheet products produced out of Twin Roll Casting Technology (TRC), managing research and development projects on developing new alloys compatible with TRC technology, characterization of as-cast structures and related casting defects, interface between liquid metal and caster shell surface, solidification in TRC and related microstructures, tailoring microstructural features starting from casting and in further downstream operations, improvement in productivity of casting process and finally casting of high Mg-bearing and 6000-series alloys with TRC. Dr. Dündar holds a B.Sc. degree in Metallurgical Engineering from Middle East Technical University, Turkey, an M.Sc. degree in Materials Science from State University of New York at Buffalo, USA, and a Ph.D. degree in Materials Engineering from New Mexico Institute of Mining and Technology, USA.

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