# TABLE OF CONTENTS

## VOLUME 1

### HOWE MEMORIAL LECTURE

What Have We Learnt About the Corrosion of Stainless Steel Since 1934? ................................................................. 1  
Carolyn M. Hansson

### SAFETY & HEALTH

The Building Blocks of Effective EHS Leadership ........................................................................................................... 15  
Malcom Dunbar

An Early Warning System for Scrap Radioactivity ............................................................................................................. 23  
Steve Steranka, Jocelyn Baynes

### SAFETY & HEALTH/MATERIAL HANDLING/TRANSPORTATION & LOGISTICS

Interactive VR Video for Mobile Equipment Safety Training ............................................................................................... 33  
Youxin Luo, Kyle Toth, John Moreland, Michelle Block, Garrett Page, David S. Rosenbalm, Chenn Zhou

### ENVIRONMENTAL

Study of Comprehensive Reutilization of Iron-Bearing Dusts ........................................................................................... 43  
Donghai Li, Haiquan Yong, Lei Luo, Baolong Luo

Crystallization Behavior of CaO-SiO$_2$-MgO-Al$_2$O$_3$-Based Slags and Its Potential Application in P-Bearing Steelmaking Slags ......................................................................................................................... 49  
Zhanjun Wang, Il Sohn

BOF Slag: Turning Waste Into Value ...................................................................................................................................... 55  
Ragunath N, Bikram Konar, Arunava Maity, Saikat Chatterjee, Anand Senguttuvan, Kinnor Chattopadhyay

Predictive Tools and Innovations in the Ventilation of Cooling Beds ............................................................................... 67  
Edmund G. Baltuch, Siegmar U. Baltuch

Gigantic Steel Structures to Cover and to Seal Large Shipyards and Dry-Docks for Ship Repairing, Dismantling and New Shipbuilding Operations ................................................................................................. 75  
Giorgio G. Parodi, Giammario Bolognini, Marco Garibaldi

Evaluation of Techno-Economic Viability of Carbon Capture Utilization and Storage (CCU&S) With Carbon Credits for Steel Plants ....................................................................................................................... 83  
Arunava Maity, Saptarshi Bhattacharya, Souptik Bose, Saikat Chatterjee, Atanu Mukherjee

Latest Development and Application of ECIA Material Handling Technologies ................................................................. 97  
Zhanwen Liu, Ting Lei, Yu Ai, Hongliang Yue

Environmental and Personnel Safety Advantages of On-Line Robotic Water Tower Cleaning ............................................ 109  
Steven Rydarowski, Randi Morgan, Joe Leist

Reduction of Operational Cost and Zero Water Consumption by Meltshop Cooling System Upgrade ............................. 123  
Giovanni Bolcato, Gianmaria Zanni, Luca Campagnolo, Giorgio Ravagnan

### ENVIRONMENTAL/ELECTRIC STEELMAKING

Improving an EAF Air Pollution Control System Using New Filter Technologies ............................................................... 129  
Tim Fisher

Biocarbon Materials in EAF Steelmaking ............................................................................................................................. 137  
Ka Wing Ng, Xianai Huang, Louis Giroux, Delin Li

New Developments on Pressure Drops’ Reduction of the APC for EAF to Decrease the OpEx ........................................ 155  
Marco Peter Cudicio, Antonio Della Gaspera
Innovative Top Combustion Hot Stoves of Kalugin Design for High Technical and Environmental Performance
Sergey Ivlev, Boris Prokofyev, Yury Murzin, Anton Subbotin, Marina Kalugin, Maxim Aksyushin, Lubor Kucera

Application of On-Line Laser Detector of Burden Surface Profile on Chaoyang No. 1 Blast Furnace at AnSteel
Zhenghai Guo, Jianhua Dai, Tianjun Yang, Hongyu Zhang, Guangwei Wang, Deshun Hu, Xiliang Liu, Baodong LV, Tai Guo, Fan Zhang

DIRECT REDUCED IRON

Getting the Most From Raw Materials: Iron Unit Yield From Ore to Liquid Steel via the Direct Reduction/EAF Route
Vincent Chevrier, Christopher Manning

Assessment of The Impact of Rising Levels of Residuals in Scrap
Jeremy A. T. Jones

Carbon and Oxygen Usage in the EAF — Is More Always Better?
J. Kevin Coitchen, Zane Voss

Effect of Carbon Bonding State and Concentration on Melting of Direct Reduced Iron
Geonu Kim, Yilmaz Kacar, P. Chris Pistorius

Design of a Pilot Plant Using the Flash Ironmaking Process: The Path to Commercially Developing a New Form of Ironmaking Using Hydrogen
Christopher Ravenscroft, Edward Green

A Way to Produce Higher Steel Grades by Retrofitting Existing Syngas Production Plants
Dario Pauluzzi, Alessandro Martinis, Ashton Hertrich G

Lime-Magnetite Pellets (LMPs) for Ironmaking
Sumeet Purohit, Geoffrey Brooks, Akbar Rhamadani, Mark Pownceby, N. Ware

CFD Simulation of Dry Density Separation of Iron Ore Fines
Anand Senguttuvan, Ganesh Chalavadi, Ranjeet Singh, Achintya Das

Reduction Behavior of DRI Pellets
Chandra Shekhar Verma

Quality Prediction and Control in Coal-Fired Rotary Kilns at Tata Sponge Iron Ltd.
Sampurna Borah, Shubhajit Mondal, Puneet Chaudhary, Brahma Deo, Susil Kumar Sahoo, Parimal Malakar, Gyanranjan Pothal, Partha Chattopadhyay

Operation of Coal-Based Sponge Iron Rotary Kiln to Reduce Accretion Formation and Optimize Quality and Power Generation
Shubhajit Mondal, Puneet Chaudhary, Sampurna Borah, Brahma Deo, Susil Kumar Sahoo, Parimal Malakar, Gyanranjan Pothal, Partha Chattopadhyay

Failure Analysis of Feed Gas Tubes Used in Direct Reduction Plants
Carlos Ansió

ELECTRIC STEELMAKING

Intelligent Melting System at Kroman Çelik EAF: Performance Results During One Year of Operation
Marco Ansoldi, Damiano Patrizio, Manuele Piazza, Orhan Kuran

VOLUME 2

Vibration Analysis on Electrode Column in AC EAF Based on Local Force Densities Developed by Rapid Change of Current and Arc Stability
Bipin Richharia, Tumil Selvan Nagarajan, Juan Ramon Fernandez, Anil Seemon

Operational Results of the Inteco Burner System at Nucor Steel-Berkeley
Daniel Holmes, Martin Leber, Paul Shikhemetoff

Performance of the Electromagnetic Stirring System Applied to the Flat Bath Consteel® Operation
Francesco Memoli, Andrea Grasselli, Joakim Z. Andersson, Anders F. Lehman, Lidong Teng

Effect of Slag on Arc Characteristics in the EAF
PK Ghosh

Numerical Investigation of Decarburization Reaction Characteristics in an Electric Arc Furnace Steelmaking Process
Yuchao Chen, Yu Wang, Guangwu Tang, Armin Silaen, Kyle Vanover, Chenn Zhou
Increasing the Safety and Reliability of the EAF: Installation of the EAF Roof Designed and Manufactured With Spray-Cooled Technology ................................................................. 797
Fredrik Boman, Markus Abel, Scott Ferguson, Logan Wilson

Zinc Production From EAF Dust at Cape Gate — A Case Study ........................................... 805
Massimo Maccagni, Edoardo Guerrini, Jonathan Nielsen, Federico Picciolo

Artificial Intelligence Applications in Production Planning at the Big River Steel Self-Learning Factory ................................................................. 815
Wilfried Runde, Klaus Ptaszyk, Jochen Neuer, Franck Adjogble

Using Thyristor-Controlled Series Reactors to Improve EAF Productivity and Lower Operating Costs at North Star BlueScope Steel LLC .................................................. 823
Michael Campbell, Tom Ma, Rex McClung, Meldon Hull, Jeremy Cargill

Application of a Man-Less, On-Demand Immersion Optical Temperature Measurement Device at the EAF ......................................................................................... 835
Paul Turner, Jeremiah Fredrick, Alex England, Bob LaRoy, Brent Walchuk, Tim Bosserman

OXYGEN STEELMAKING

Development and Industrial Validation of a New Lime-Based Slag Conditioner in the BOF Process at Dillinger ................................................................. 849
Michael Nispel, Józef Noldin, Katharina Kortzak, Helmut Lachmund

Production of Ultralow-Phosphorus Steels in the BOF: Meeting the Technical and Operational Challenges ................................................................. 859
Brahma Deo, Kanan Sahoo, Sunil Kumar

Influence of Fluxes in Steel Desulfurization ................................................................. 869
Anna Paula Littig Berger, Rodrigo de Oliveira Pezzin, Heitor Cristo Clem de Oliveira, Silas Gamarine Soares, Henrique Silva Furtado, José Roberto de Oliveira

First Movable KR in India Has Successfully Started Up in JSW Steel at Vijayanagar ................................................................. 881
Masashi Nawaufune, Kyohara Ito, Abhijit Sarkar, Navin Desai

Multi-Lance Probe for In-Blow and End-Blow Applications: A Fast Converter Sample Analysis ................................................................. 891
Jan Cooper, Marc Vergauwen, Dries Beyens, Mireille Maenhoudt

BOF Process Optimization and Technology Improvements at Ternium Brazil ................................................................. 897

Slag Splashing: Blow Parameters Equationing ................................................................. 913
Inamara Amanda Souza Santos, Aline Lima da Silva, Vanessia Rodrigues de Medeiros Santos, Willian dos Reis Lima, Bruno Maia, Daniel Augusto Godinho de Carvalho

Advanced Equipment Tracking in High-Temperature Production Environments at voestalpine and Dillinger ................................................................. 923
Andreas Rohrhofer, Swathish Thazhath Johnne, Christian Zeitzer, Kerstin Meder

Intelligent BOF Steelmaking System — Research and Application of Intelligent BOF Steelmaking ................................................................. 931
Chunlai He, Xingli Zhong, Yong Wang, Lei Ai, Hongsheng Jia, Liang Zhao, Jingsong Wang, Pei Zhang

BOF Oxygen Lance Tip Laser Scanning and 3D Modeling for Wear Evaluation ................................................................. 935
Tyler Preall, Steven Gillgrass

Use of Multivariate Analysis Data in the Study of Slag Slopping of BOF ................................................................. 943
Bruna Helena Malovini Loiola, Henrique Silva Furtado, Paulo Santos Assis, Moacir Andretti Sabino Mota, Lucas Vinicius da Cruz, Gabriel Marques Magalhães Mourão, Cecilia Laia da Silva, Ivalahn Alves da Silva, Carlos Antônio Silva

Operating Experiences of Post-Combustion Lances at Liberty OneSteel – Whyalla Steel Works ................................................................. 951
Peter Suchanek, Funagai Paraiso, Steven Gillgrass, Mike Strelbisky, James Tyler

BOF Processing by a Static and Dynamic Model With Automatic EOB Detection: Recent Results ................................................................. 965
Axel Hofmann, Uwe de Fries, Satyajit Das

Evaluation of Mixing and Mass Transfer at Ternium Brazil's BOF Through Cold Model Experiments ................................................................. 979
Debora Silva, Mariana A. Ribeiro, Raissa S. Salgado, Roberto Parreiras Tavares, Bruno Maia, Daniel Augusto Godinho de Carvalho, Johannes Schenk

Effect of Top and Bottom Blowing Condition on Spitting Phenomenon in the Converter ................................................................. 987
Shota Amano, Shingo Sato, Yukio Takahashi, Naoki Kikuchi

Static and Dynamic Control Model of BOF Steelmaking Process and Its Validation With Steel Plant Data ................................................................. 997
Ajay Shukla, Shwetank Pandey, C. Srishilan, D Satish Kumar, Marutirama Kazha

Reduction of Severe Erosion in the Basic Oxygen Furnace Vessel at Tata Steel, India ................................................................. 1009
Mrityunjay Kumar Singh, Ashutosh Kumar, Rohit Agarwal, Biswajit Ghosh, Debasish Das, Dirk van der Plas, Hans Pronk, Sudhansu Pathak
SPECIALTY ALLOY & FOUNDRY

Effect of Physical State of Non-Metallic Inclusions on the Accumulation Within Magnesia-Stabilized Zirconia Foam Filters
Soumava Chakraborty, Ronald O'Malley, Laura Bartlett, Logan Huddleston

Designing a Graphitic White Iron: Microstructures and Properties
Jie Wan, Jingjing Qing, Mingzhi Xu

AOD Process Control: From Slide Rule to Factory Automation
Allen Chan, Hamzah Alshawarghi

Extension of Stainless Steel Refining Complex by Twin Tank VOD Unit
Thomas Eichert, Volker Wiegmann, Jochen Schlueter, Rainer Teworte

Hydrogen Control of Large Bottom Poured Forging Ingots at Ellwood Quality Steels
Bjorn Gabrielsson, Brendan Connolly, Steve Lubinski, Sean Cowden, Hongliang Yang

LADLE & SECONDARY REFINING

Refractory Condition Monitoring and Lifetime Prognosis for RH Degassers
Andreas Viertaufer, Nikolaus Matsam, Franz Pernkopf, Andreas Gantner, Georg Grimm, Waltraud Winkler, Gregor Lanner, Alexander Ratz

Pyrophoric Dust Formation During Vacuum Degassing: Uncovering the Determining Factors
Marco Vidonis, Franco Gandin, Harald Koblenzer

Improvement of Vacuum Degasser Cover
Keita Sumida, Akito Setoguchi, Kenji Yoshizawa, Masato Yoshitsune

Effect of Snorkel Shape on Refining Efficiency of RH Treatment
Chang Liu, Yanyu Zhao, Kaiyu Peng, Lifeng Zhang

Use of Sound Signals in Analyzing Flow Behavior in Steel Vessels
Rohini Kadam, Geoffrey Brooks, Michelle Dunn, David Sly

TenarisTamsa's Ladle Furnace Electrode Consumption Reduction
Francisco Raul Aguirre Ortiz, Pablo Enoch Hernandez Paredes

Fluid Flow Turbulence in the Proximities of the Metal-Slag Interface in Ladle Stirring Operations
Fabian Calderon-Hurtado, Rodolfo Morales, Kinnor Chattopadhyay, Saul Garcia-Hernández

Kinetic Study of the Nitrogen Reaction With Liquid Third-Generation Advanced High-Strength Steels: Experimental Design and Industrial Significance
Dai Tang, P. Chris Pistorius

Non-Metallic Inclusion Change in the Third-Generation AHSS With High Manganese, Aluminum and Silicon Contents
Dai Tang, P. Chris Pistorius

Recent Development to Control Nitrogen Content of High-Alloy Steel by Optimization Treatment Conditions at the Secondary Refining Process
Satoshi Sugihara, Kohel Hosokawa, Takashi Yamashita

Slag Engineering for Phosphorus Removal in the EAF and Sulfur Removal in the Ladle
Sunday Abrahum, Yufeng Wang, Randy Petty, Tony Franks, Tim Sprague, Gary Brown, Wesley Woods, Wesley Nicholson, Miles Haberkom, Rick Bodnar

Slag Capacity on Inclusion Removal: An Experimental and Thermodynamic Investigation
Vinicius Cardoso da Rocha, Pedro Cunha Alves, Julio Anibal Morales Pereira, Wagner Viana Bielefeldt, Antônio Cezar Faria Vilela

Development of Alternative Flux for Liquid Steel Desulfurization
Saikat Chatterjee, Bikram Konar, Arunava Maity, Kinnor Chattopadhyay

LADLE & SECONDARY REFINING/METALLURGY – STEELMAKING & CASTING

Optimization of Ca Additions for Inclusion Modification
Yilmaz Kacar, Bryan Webler, P. Chris Pistorius

Evolution of Inclusions in High-Sulfur and Low-Oxygen Steels After Calcium Treatment
Xiaohui Sun, Weijian Wang, Yan Luo, Ji Zhang, Ying Ren, Lifeng Zhang
CONTINUOUS CASTING

Process Improvements at a Continuous Caster Using CasTemp SuperHeat ................................................................. 1249
  John Pischek, Alex England, Steve Walker
Influence of Oscillator on Operation Stability in Mini-Mill Casters ........................................................................... 1257
  Min-chul Shin, Byeong-ja Ha
Crystallization Behavior Evaluations of the Mold Powder by DTA ........................................................................... 1265
  Masanori Okada, Daishuke Katayama, Jim Gilmore, Yukimasa Iwamoto
A Novel Approach to Self-Start Open-Stream Casting ............................................................................................... 1275
  Ashwani Kumar, Krishna Murari Choudhury, Navneet Sinha, Amarnath Mukherjee, Amit Banerjee
Electrical Oscillation Drive With Adjustable Stroke and Frequency During Operation ............................................. 1281
  Dino Kabosh, Stephan Feldhaus, Giovanni Michelon, John Gregord, Nicholas Klipa, Christopher Sanford
Industry 4.0 Technologies Applied to Casting Machines .............................................................................................. 1287
  Gianluca Maccuni
Increasing Safety, Operation Efficiency and Process Reliability: Implementation of Robotized Tundish Operations at Ternium Brasil .......................................................... 1291
Industry 4.0 Technologies Applied to the Meltshop ....................................................................................................... 1303
  Nicola Bertoni
Development of Oxygen-Enriched Burner Suitable for Tundish Pre-Heating: “Innova-Jet Swing” ................................. 1309
  Takeshi Saito, Yasuyuki Yamamoto, Yoshihito Hagihara
Effect of Bubble Behavior for a Stopper Rod With Multiple Side-Channel Injection on Bubble Size Distributions in Nozzle and Mold During Continuous Casting of Steel .................................................. 1317
  Seong-Mook Cho, Brian Thomas
Demystifying the CC Mold at the University of Toronto: The First Full-Scale Mold Water Model in North America Academia .............................................................................................. 1331
  Bikram Konar, Donghui Li, Kinnor Chattopadhyay
Study on Instantaneous Transport Phenomenon Along the Full Continuous Casting Slab Strand .................................. 1345
  Wei Chen, Wei Li, Lifeng Zhang
Effect of Different Types of Nozzles on Swirling Flow Development and Shell Growth Behavior in a Bloom Casting Mold .................................................................................................................. 1363
  Pu Wang, Shaoliang Li, Zhangpeng Tie, Huasong Liu, Haiyan Tang, Peng Lan, Jiuquan Zhang
The Effect of Upper Nozzle Refractory in Bubble Behavior Inside the SEN and Slab Mold in Continuous Casting: Physical and Mathematical Model ........................................................... 1373
  Paulo Luiz Santos Junior, João Jesus Moi Peixoto, Carlos Antônio Silva, Itauhah Alves da Silva, Clenice Moreira Galinari, Varadarajans Seshadri
Influence of Electromagnetic Stirring Position on Liquid Level Fluctuation in Billet Mold ............................................... 1383
  Jiang Qi, Guifang Zhang, Yang Yindong, Yan Peng, Zheng Wei, Shi Benhui
The Most Advanced Thin-Slab Technology for Coil-to-Coil Production ....................................................................... 1389
  Tristan Toepfer, Christian Bilgen, Mathias Knigge
The New Generation of Thin-Slab Casting and Rolling Plant for No Production and Market Limitations ............................ 1395
  Alessandro Pigani, Paolo Bobig, Mike Knights, Mathias Knigge
voestalpine Stahl GmbH — CC8 Caster for High-Quality Grades and Exposed Automotive Steel Using Danielli Technology .................................................................................................................. 1401
  Gabriele Paulon, Loris Busolini, Thierry Gautreau, Herbert Moser, Peter Hodnik
Tokyo Steel CCM4: A New Danielli Technology ........................................................................................................... 1411
  Marcellino Fornasier, Luigi Morsut, Michele Papinutto, Naoyuki Takeuchi, N. Boldrini
The Effect of Standoff Distance on the Cooling Efficiency of Air Mist and Hydraulic Nozzles ........................................ 1417
  Kenneth Blazek, Rudolf Moravec
Numerical Investigation of Spray Cooling at Various Operation Conditions During Continuous Casting of Steel .......................................................... 1425
  Haibo Ma, Rui Liu, Michael Lowry, Armin Silaen, Chenn Zhou
Investigation of Water Droplet Impingement Under Conditions of the Secondary Cooling Zone of a Continuous Slab Caster: ......................................................................................... 1441
  Lukas Preuler, Mario Peña, Christian Weiß, Christian Bernhard, Sergiu Ilie
Optimizing Application of Chlorine to Continuous Caster Spray Water System .......................................................... 1451
  James Gleason
Tundish Open Eye Formation: Integrated Troubleshooting Using Computational Modeling, Physical Modeling and Plant Trials ................................................................. 1455
Bikram Konar, Donghui Li, Jackie Leung, Joydeep Sengupta, Kinnor Chattopadhyay

Nailed It! Measurement of Steel Surface Velocity in the Tundish With Open Eyes .............................................. 1467
Jackie Leung, Donghui Li, Kinnor Chattopadhyay

Efficient Determination of Misalignment of Ladle Shroud Using Machine Vision .................................................. 1479
Arjit Das, Saikat Chatterjee, Atanu Mukherjee

HOT SHEET ROLLING

Feedback Control for Hook, Camber, Wedge and Strip Steering in a Hot Strip Mill .......................................................... 1491
Matthias Kurz, Klaus Löhne, Niklas Petrasch

Advanced Engineering Maximizes Efficiency and MTBR of Descaling Pumps ................................................ 1503
Ken Babusiak, Bob Jennings

VOLUME 3

Optical Strip Flatness and Shape Measurement in Hot Strip Mills ............................................................................. 1509
Pär Kierkegaard, Hans Sollander, Mats Hallström

Innovation Cooling Model: The Future Starts Now ........................................................................................................... 1517
Klaus Weinzierl, Alexander Reljic, Eduard Hermann

Data-Driven Dynamic Feedforward Compensation Method for Coiling Temperature Control in Hot Strip Mills .................................................................................. 1525
Atsushi Suzuki, Naoki Shimoda, Yang Guiling, Wen Xiong

Arvedi ESP: Reaching Maturity in Endless Casting and Rolling Technology .......................................................... 1537
Andi Jungbauer, B. Linzer, T. Lengauer, S. Grosseiber

New Constructed Hot Strip Mill for Formosa Ha Tinh Steel Co. in Vietnam ......................................................... 1545
Longze He, Jo Iwamoto

New Control Concept for ESP Thin-Gauge Rolling Improves Thickness Quality ...................................................... 1553
Daniel Kotzan, Ansgar Graess, Andreas Materhafer

Technical Solutions for Safe Handling of High-Strength Steel Coils .......................................................................... 1563
Ulrich Cramer, Thomas Holzhauer, Christian Mengel, Michael Peretic

Modernization of Shandong Steel 1,700-mm Hot Strip Mill ..................................................................................... 1571
Hai Yu, Jingxin Wu, Huaping Niu, Changzong Hu, Xiaogang Tian

Induction Bar and Edge Heating Technology in the Hot Strip Mill ........................................................................ 1579
Gary Gepitulan, Hirokuki Imanari, Eiji Hashimoto, Tetsuji Doizaki

New Finishing Mill Technology for the Production of Thin Hot Band ..................................................................... 1587
M. Hackl, A. Seilinger, S. Brugin, Konrad Krimpelstaetter

Some Sources of Variation in the Strength of Hot-Rolled Strip ............................................................................. 1595
Eugene Nikitenko

Predictive Process Control — The Next Step to Quality Assurance ............................................................................. 1599
Michael Breuer, August Sprock, Michael Peretic

In-Situ Observation and Formation Mechanism of Iron Surface Oxidation in the Initial Stages at 1,150°C .......................................................... 1607
Ming Zhong, Yining He, Elyce Milligan, P. Chris Pistorius, Bryan Webler

Holistic Approach of Real-Time Product Quality Management at New Integrated Steel Plant, Shandong Iron & Steel, Rizhao, China ........................................................................ 1615
Wolfgang Spies, Ingo Schuster, Xiangyang Chen

COLD SHEET ROLLING

China’s Bayi Steel Pickling Line and Tandem Cold Mill ................................................................................................. 1629
Leigang Gu, Xiaojun Yu, Bin Li, Erhu Xie, Yeke Wang, Xianjun Liu

Zoom-Mill for Reversible Cold Rolling ............................................................................................................................ 1641
Tanehiro Kikkawa, Tepppei Tsuzuki

Hot Skin Pass Mill and Tension Leveler Line for Ultrahigh-Strength Steel .................................................................... 1651
Ryutaro Ota, Hiroyuki Uematsu
Dramatically Increasing Tension Leveler Capacity on an Existing Pickler Without Increasing Line Length
Ian Bowman, Daniel Cullen, Jeffrey McLain, Pete Tortorici ............................................................... 1661

Advanced Control for the Threading of a Tandem Cold Metal Sheet Mill
John Pittner, Marvan A. Simaan ........................................................................................................... 1669

Chatter Management at Cold Rolling Mills Today
Matthias Krüger, Sebastian Richard, Michael Peretic ........................................................................ 1683

Improved Material Yield and Operation Stability in Cold Rolling Mills
Detlef Bittner, Wolfgang Spies, Jörg Siegbarth .................................................................................. 1693

A Study of High-Temperature Defects Detected on Light-Gauge Coated Sheet Steel
Jagannith Tripathy, Donna DeMark, Cody Dyar, Anthony Bader, Mark Pole, Jeff Roach ...................... 1699

Lubricant Development for Hard Steel Rolling: From Design to Validation
J.B.A.F. Smeulders ............................................................................................................................... 1709

Thermal Stains Improvements at Reversing Cold Mills
Leonardo Nieves, Jesus Morales, Marco Gonzalez, Sofia Valdes .......................................................... 1723

Advanced Thickness and Flatness Control System for Sendzimir Mill
Toshihiro Nii, Liqin Yao, Jian Gong ...................................................................................................... 1735

Differences of CO₂ and Solid-State Laser Welding in Industrial Flat Steel Production
Felix Weghofer, Deni Bellai, Christian Binroth .................................................................................. 1745

Revamping of Existing RCM to “Hyper UC-Mill”
Toru Nakayama, Ke Hu, Xingliang Yang, Mingcheng Ye, Shinichi Yasumari, Takayoshi Tomino ............. 1753

GALVANIZING

Optimizing Coating Weight at U. S. Steel Midwest Plant No. 3 Continuous Galvanizing Line
Ryan Jolivet, Ivan Marincic, Owen Pearcey, Mark Roberts, J. Tham, Kevin Young, Matthew McCasby 1765

Unsteady Three-Dimensional Numerical Model Development for the Investigation of the Gas Jet
Wiping Process on Flow Behaviors Near the Galvanizing Bath Surface
Kintak Raymond Yu, Florin Ilinca, Frank Goodwin ......................................................................... 1781

Minimization of the N₂ Dilution When Wiping in Air
Michel Dubois ....................................................................................................................................... 1791

Twisting Towers to Couple Process in a Non-Linear Way
Michel Dubois ....................................................................................................................................... 1801

Annealing and Galvanizing of Third-Generation AHSS Grades
Fritz Brühl, Caesar Sasse, Keith Watson .............................................................................................. 1809

Oxide Stability Analysis and Characterization in a Galvannealed Dual-Phase Steel Exhibiting Coating
Defects.................................................................................................................................................. 1819
Ryan Plessinger, Sridhar Seetharaman, Emmanuel De Moor

Steel Dynamics’ New Continuous Coil Coating Line for Steel Strip
Simone Dolcan, Enrico Romano, Jeff Bauman, Duke Liddell, Nathan Wenning ................................. 1829

Installation of Coating Equipment for Chromate-Free Products in JFE Fukuyama No. 2 CGL
Yusuke Naka, Tetsuo Horisawa, Hidekazu Marukawa, Yoshikazu Suzuki, Takaumi Kanayama ............. 1841

Revamping of GL#4 at Hoa Sen Phu My Plant (Vietnam)
Gordon Kohler, Nguyen Than Phat, Andrea Alessandrini, Anil Nimbalkar ............................................ 1849

Upgrade of ArcelorMittal Indiana Harbor #2 Galvanizing Line Making 2CGL Great Again
John Seaman, David Parker, Robert Vanderzee ...................................................................................... 1861

PLATE ROLLING

Influence of the Normalizing Rolling Parameters on the Toughness of a Nb, V and Ti Microalloyed
Steel Processed in the Gerdau Plate Mill
Ricardo Faria, Antonio Gorni, Daniel Bojikian Matsubara, Romeu Viana Jr., José Herbert Dolabela da Silveira, Marcelo Rebellolo 1873

Metallurgical Strategy for Optimized Production of QT High-Strength and Abrasion-Resistant Steels
Douglas Stalheim .................................................................................................................................. 1881

Systematic Development of a Rotary Descaling Device
Dirk Schulze Schencking ...................................................................................................................... 1893

Reduce Oxide Dust Without Compromising Product Quality
Bob Schaming, Nathan Lora .................................................................................................................. 1899
Sub-Arctic Toughness From API Coiled Plate on a Steckel Mill ........................................................................................................ 1907
John Hinton, Andrew Harvey, J. Lee, M. Arafin, L. Collins, K. Dunnett

A Recent Application of Advanced Cooling Technology to Improve High-Strength Plate Steel Production .......................................................................................................................... 1917
Ian Robinson, Joachim Kilato, John Hinton

LONG PRODUCTS

Danielli Equipment Boosts Uptime in Bars Peeling .......................................................................................................................... 1925
Mauro Zamolo

High-Speed Drawing of Wire Coils With Chain Track Technology .................................................................................................................. 1931
Mauro Zamolo

Endless Casting and Rolling of Long Products: The Competitive Substitute of Conventional Mini-Mills .................................................................................................................. 1935
Aldo Tellatin, Andrea De Luca, Jozi Shuli

Automated Coil Trimming System for Wire Rod Mills in the Digital Era .................................................................................................................. 1943
Sudhakar Teegavarapu, Matthew Palfreman, William Shen, Jason Zelle

Robotic Tagging Applications .................................................................................................................................................................................. 1953
Antonio Ambra

High-Quality Wire Rod and Bar Production at YongXing Special Stainless Steel .................................................................................................................. 1959
J. Hsueh, S.M. Shore, Riccardo Masini

Improving Periodic Defect Detection in Hot-Rolled Long Products by Means of a Combination Between Eddy Current and Vision .................................................................................................................. 1971
Bruno Chedal-Anglay, José Ignacio Lucas Fuentes, Jose Ignacio Diaz

Prediction of Mechanical Properties of Microalloyed Medium-Carbon Wire Rods and Bars .................................................................................................................. 1979
Roney Lino, Ernani Lima, Leticia Barbosa, Helder Ferreira, Joaquim Costa, Ronaldo Barbosa

Study on Removal of Brittle Phases by Optimizing the Process Parameters of Welding Wire Rod Grade for Gas-Metal Arc Welding Applications .................................................................................................................. 1987
Erhan Sakalli, Serdar Güney, Hamdi Gilt, Ahmet Saglam, D. Özçayt, Erdil Gönülalan, Oguz Gündüz

Understanding the Role of Nb in Hot-Rolled Rebar: Influence of Final Geometry and Process Parameters .................................................................................................................. 2001
Felipe Bastos, Beatriz Pereda, Beatriz Lopez, Jose M. Rodriguez-Ibabe, Marcelo Rebellato

Strengthening Effects and Processing Optimization of Niobium on High-Strength Rebar .................................................................................................................. 2013
Zhang Yongqing, Jose M. Rodriguez-Ibabe, Zhang Weyi, Cao Jianchun, Guo Aimin, Marcelo Rebellato

PIPE & TUBE

Innovation in the Analysis of Ultrasonic Cleanliness Test Data for Hot-Rolled Steels .................................................................................................................. 2025
Vinicius Freitas Paixão, Giovanna Lorena Carneiro Costa, Ana Paula Silva, Amarildo Ferreira

Effect of Rolling Conditions on Ductile Fracture During Piercing .................................................................................................................. 2035
Tatsuro Katsumura, Hiroki Ota

Eliminating Red Rust and Improving Customer Satisfaction .................................................................................................................. 2041
Michael Kelly

ROLLS

The Next Generation of Mill Roll Inspection Systems: A Case Study of a New Inspection System .................................................................................................................. 2061
Borja Lopez, Joseph Baczynsky

An Environment-Friendly Replacement for Hard Chrome Coating of Work Rolls in Cold Rolling Mills and Continuous Casting Molds .................................................................................................................. 2069
Ersan Ilgar, Hamoun Khalili, Amy Haghdoost

METALLURGY – STEELMAKING & CASTING

Investigating Centerline Bridging in Continuous Casting During Speed Drops With ConOffline .................................................................................................................. 2075
Zhelin Chen, William Drennan, Brian Thomas, Joseph Bentsman
Analysis of Phosphorus Band in Interstitial-Free High-Strength Steel ...................................................... 2085
Avinash Kumar, Shaina Suresh, Ravinder Pathania, Subhajit Maity, Ranjay Singh, Sudipto Sarkar, Akshay Khullar, Vinay Mahashabde

An Automated Quantitative Assessment of Slab Centerline Segregation Using Image Analysis .................. 2093
John Somasundaram, Siddhartha Biswas, Denis Hennessy, Amar De

Pre-Fused vs. Blended Fluxes: Their Impact on Cleanliness of Low-Carbon Low-Alloy Steel .................. 2101
Rodrigo Lencina, Bo Zhang, Annelies Malfliet, Yaxin Chen, Bruno Touzo, Bart Blanpain, Maxing Guo

Lime Dissolution in the BOF Process ................................................................................................................. 2111
Ludimila Vieira, Henrique Silva Furtado, Heitor Cristo Clem de Oliveira, José Roberto de Oliveira

Use of Synthetic Slags to Control the Level of Inclusions in Steels .................................................................. 2119
Estefano Vieira, José Roberto de Oliveira, Felipe Grillo, AP Martins, Heitor Cristo Clem de Oliveira, Henrique Silva Furtado

Changes to the Characteristics of Inclusions Upon Solidification in AHSS Steels ............................................. 2131
Chengsong Liu, Bryan Webler

Development of a Powder Metallurgy Technique for Introducing Synthetic Oxide Inclusions Into Liquid Steel ............................................................................................................................................. 2137
Andrew Smith, Tu Tran, Fazhong Ji, Wouter Tiekink, Gert Abbel, Steve Verdier

Growth Mechanism of Clog Materials in SEN During Continuous Casting of Ti-Added ULC Steel ............. 2147
Joo-Hyeok Lee, Sung-Kwang Kim, Myeong-Hun Kang, Youn-Bae Kang

Inclusion Classification by Computer Vision and Machine Learning .............................................................. 2155
Nan Gao, Mohammad Abdulsalam, Michael Potter, Gary Casuccio, Elizabeth Holm, Bryan Webler

METALLURGY – STEELMAKING & CASTING/COMPUTER APPLICATIONS

Development of a Predictive Model for Minimizing Ladle Desulfurization Cycle Time and the Associated Costs ............................................................................................................................................. 2161
Raghav Mittal, Anand Senguttuvan, Saikat Chatterjee, Atanu Mukherjee

3D Thermal-Mechanical Model of Solidifying Steel Strand ............................................................................ 2175
Matthew Zappulla, Guoming Zhu, Brian Thomas

An Optimization Model for Making Alloy Additions During Steelmaking at SSAB Iowa ................................ 2187
Yufeng Wang, Sunday Abraham, Rick Bodnar, Randy Petty, Gary Brown, Preston Schaaf, Myrissa Mayfield

Effect of M-EMS on Steel Solidification Behavior of a Round Billet Casting .................................................. 2195
Shaoliang Li, Pu Wang, Haiyan Tang, Ming Luo, Peng Lan, Zhonghua Zhang, Jiaquan Zhong

Development of a Predictive Tundish Open Eye Model Using Artificial Neural Network (ANN) ................. 2207
Alvin Ma, Raghav Mittal, Saikat Chatterjee, Kinnor Chattopadhyay

Modeling of Multiphase Flow and Argon Bubble Entrapment in Continuous Slab Casting of Steel ............. 2219
Mingyi Liang, Seong-Mook Cho, Hamed Olaa, Lipsa Das, Xiaoming Ruan, Brian Thomas

METALLURGY – PROCESSING, PRODUCTS & APPLICATIONS

Practical Mitigation Procedures to Control Hydrogen-Related Damage During Production of Structural Steels ............................................................................................................................................. 2233
Douglas Stalheim

Sample Preparation Methods for Total Hydrogen Testing ................................................................................ 2245
Michael Wowk, Mohammad M. Rahman

Applications for Portable XRF, OES and LIBS Analyzers in Steel and Metals Industries: A Guide for Selection ......................................................................................................................................................... 2255
Jordan Rose, Mikko Jarvikivi

Effect of Allotriomorphic Ferrite Thickness on Advanced High-Strength Steel Toughness ............................... 2259
Rafael Coura Giacomin, Bryan Webler

Effect of Solution Treatment on Grain Size and Toughness of Lightweight Fe-Mn-Al-C Steel ....................... 2271
Daniel Field, Krista Limmer

Effect of Inclusions on the Properties of High-Grade Cold-Rolled Non-Oriented Silicon Steel ...................... 2281
Li Xiang, Shengtuo Qiu, Pei Zhao, Yingdong Yang, Mansoor Barati, Alexander McLean

Advanced Continuous Annealing Technology and Application for High-Strength Steel ............................... 2289
Qiang-qiang Xia, Xin-guo Liang, Yeke Wang, Leigang Gu
Effects of Furnace Atmosphere on the Post-Anneal Adhesion Capability of Insulation Coating to Electrical Steel Substrates ............................................................................................................................... 2299
Kang-Yang Peng

Study on Phase Transition and Precipitation Behavior of FeCrAl Stainless Steel During Equilibrium Solidification ............................................................................................................................... 2311
Zhengjiang Deng, Jianhua Liu, Yang He, Yindong Yang, Alexander McLean

Texture and Mechanical Behavior of UNS S32205 Duplex Stainless Steel Processed by Warm, Cold Rolling and Annealing ............................................................................................................................... 2319

Evolution of Oxide Inclusions in 304 Stainless Steel Treated by Rare Earth During Isothermal Heating at 1,473 K (1,200°C) ............................................................................................................................... 2327
Xueliang Zhang, Maolin Ye, Shufeng Yang, Jingshe Li, Yongfeng Chen, Jinqiang Wu

Anisotropy Evaluation of Steel Plates for Large-Diameter Pipeline Application ............................................................................................................................... 2333
Daniel Bojkikian Matsubara, Carlos Noberto Paula da Silva, Emanuelle Garcia Reis, José Herbert Dolabela da Silva, Rafael Abreu Fraga

The Effect of Heat Treatment on the HAZ Microhardness and Fracture Resistance of Weld Joints of ABS EH36 150-mm Heavy Plates for Monopiles of Offshore Wind Generators ............................................................................................................................... 2343
Eugene Goli-Oglu, Zibrandt Greisen

Process Optimization and Product Metallurgy in Long Products ............................................................................................................................... 2353
Steven Jansto

Development of Ti-Nb Microalloyed HSLA and UHSS on a Thin-Slab Casting and Rolling Mill ............................................................................................................................... 2365
Peng Zhang, Xiaoping Ma, Sang-Hyun Cho, Daniel Yang, Jitendrakumar Patel, Erminio Cerilli, Joseph Miskiw, Kate Kuuskman

Production of AHSS at Nucor Steel–Arkansas: Innovative Technology for the New Cold Mill Complex ............................................................................................................................... 2373
Peter Eisenkoeck, G. Burgel, F. Kopin, C. Bartholdt, D. Schweighofer, T. Lavric, T. Lesne, K. Williams

Mathematical Model of Static and Dynamic Recrystallization, Roll Force and Mean Flow Stress of the Nb-Microalloyed Steels for Plain Steel Hot Roughing Mill ............................................................................................................................... 2383
Marcelo Lucas Pereira Machado, Juliana Gomes dos Santos

Non-Destructive Magnetic Measurements and Thermodynamics Calculations for Evaluation of Carburization of Tubes During Pyrolysis ............................................................................................................................... 2393
Vicente Braz Trindade, Douglas Figueiredo Silva, Francislaynne Dias, Ivan Silva, Ulrich Krupp

ENERGY & UTILITIES

Power Profile Optimization in TenarisTamsa's Electric Arc Furnace ............................................................................................................................... 2401
Francisco Raul Aguirre Ortiz, Pablo Enoc Hernandez Paredes

High-Performance Waterbox Stripper Nozzle Type W5 ............................................................................................................................... 2411
Rafael Lazo, Nikhil Nafade

Systematic Optimization Creates Higher Competitiveness ............................................................................................................................... 2421
Hong Dai, Zhichun Hu, Yewen Zhang

Fuel Cost Cut by Installing Heat Transfer Enhancement Units for RT Recuporator ............................................................................................................................... 2427
Ei Okamura, Koki Sugiyama, Koji Iwata

Development and Application of Intelligent Optimal Scheduling System for the Byproduct Gas in Steel Plants ............................................................................................................................... 2437
Kun Hu

Achieving Optimal Energy Savings in Hot Strip Mills With Predictive Solutions ............................................................................................................................... 2447
Yuka Osaka, Hiroyuki Imanari, Zijun Lu, Shutaro Shinohara

New Pathways Toward Safe and Effective Cooling Systems ............................................................................................................................... 2455
Martina Hanel, Andreas Filtziwieser, Hans-Joerg Krassnig, Rolf Degel

Reheat Furnace Efficiency at Laverton Rod Mill ............................................................................................................................... 2461
Jacob Stanford, Geoffrey Brooks, Rudi Janse van Vuuren, Andrea Fontana

ELECTRICAL APPLICATIONS

Adding Life to Water-Cooled Power Cables Through Innovation in Core Construction ............................................................................................................................... 2473
Michael Pinney

How Furnace Model Predictive Control Forecasts Transitions to Enhance Strip Quality and Productivity ............................................................................................................................... 2479
Cédric Perret
A Case Study: Engineering Solutions to Production-Stifling Issues at a Steel Mill .......................................................... 2491
Matthew Conville, William Kilpatrick, Kasey May

Performance Improvements of the Reheat Furnace Level 2 Control System at AM/NS Calvert LLC .................. 2497
Daniel Pellecchia, Louis "Brian" Pueschel, Thomas Lanzendorfer

Modernization of Continuous Casting Machine in the Era of Intelligent Manufacturing ............................................... 2509
Sri Challapalli, Boris Busolotti, Andrea Polo, Marco Ometto

The Digital Twin in Continuous Casting — A New Dimension in Automation Technology ........................................ 2521
Reinhold Leitner, Daniel Fuchshuber, Christian Brugger, Paul Pannerstorfer

The Road to Digitalization Is Paved With Intelligent Solutions .................................................................................. 2531
Thomas Kuehas, Richard Stadlmayr, Wolfgang Oberaigner, Roman Aspetsberger, Reinhold Leitner, Bernhard Voglmayr

Life Extension of Motor Control Centers: When to Maintain and When to Replace .......................................................... 2543
Matt Hussey, David Durocher

Using Laser Gauges in Hot Rolling Mills .......................................................................................................................... 2551
Achim Sonntag

Optimized Heating of Steel Slabs With Radar Measurements .................................................................................. 2559
Patrik Ottosson, Jonas Engdahl, Daniel Andersson, Tomas Ekman, Fredrik Blomqvist

ELECTRICAL APPLICATIONS/COMPUTER APPLICATIONS

Successful Use Case Applications of Artificial Intelligence in the Steel Industry.......................................................... 2573
Giacomo Pellegrini, Matteo Sandri, Enrico Villagrossi, Sri Challapalli, Luca Cestari, Andrea Polo, Marco Ometto

Digital Transformation: The Edge Analytics Approach to Industry 4.0 .............................................................. 2585
David Kober

Intelligent Steelmaking Based on Advanced Analytics: Reducing Operational Costs of a BOF ........................................ 2593
Marco Lucchin, Vittorio Scipolo, Nicola Giso, Giovanni Bavastrilli

Technical Research and Application of Smart Logistics for Steel Enterprises ..................................................... 2603
Hui Liu, Xinhua Fan, Mingming Qi

Production Quality Secured by New Real-Time Plant Condition KPI Approach at Big River Steel’s CSP® Mill ............................................................................................................. 2609
Odette Schaumann, Wolfgang Spies, Helmut Hartmann, Jens Kempken

Industrial Change: Impact of Emerging Technologies on the Steel Industry .............................................................. 2619
Charles Cotton

COMPUTER APPLICATIONS

Analysis of the Effects of Oxygen Enrichment in a Reheating Furnace ........................................................................ 2629
Bethany Worl, Jianglin Fan, Armin Silaen, Jeffrey Cox, Kurt Johnson, Larry Fabina, Joe Maiolo, Kelly Tian, Chenh Zhou

A Raceway Model Based on Open-Source Software ........................................................................................................... 2641
Markus Bösenhofer, Eva-Maria Wartha, Christian Jordan, Michael Harasek, Christoph Feilmayr, Franz Hazeberger, Bernhard König

First Steps Toward the Fully Automated Steel Mill: From the Planning of Ladles to the Transport .............................. 2653
Krishnhan Premand, Felix Schuppert, Jörg Thomasberger, Wolfgang Linden

Advanced Profile Control: Model – Optimization – Contour ........................................................................................ 2659
Matthias Kurz, Marco Miele, Alexander Thekale, Jens Frenzel, Christopher Gusek, Martin Vogt

Machine Learning Approaches for the Analysis of Non-Metallic Inclusion Data Sets ........................................... 2667
Mohammad Abdulsalam, Bryan Webler

Digital Assistance Tools and Remote Service Solutions for Electric Arc Furnaces .......................................................... 2675
Thomas Reindl, Richard Stadlmayr, Brigitte Linamer

A Revised Concept of Quality Performance Measurement ..................................................................................... 2685
Cesar Abreu, Hugo Gonçalves, Julio Cesar Ferreira, Henrique Rohff

Cloud-Based Process Management of Inspection Instruments .................................................................................. 2691
Alex Thurston

PROJECT & CONSTRUCTION MANAGEMENT

A Buyer's Guide to Cranes .................................................................................................................................................. 2697
Alan Horgan, Kevin Hoffmeyer, Jennifer Pasek
Collaborative Project Management Methodology Between Major Stakeholders — A Key Success Factor
Partha S. Ghose

Driving Business Value in Industry 4.0: Big Data and Analytics for the Improvement of Steel Processes
Marcelo Saparrat, Ivonne Ibarra, Esteban Lopez, Aracely Martinez

Load-Bearing Structural 'Assembly'
Bradford Russell, Roman Okelo

MAINTENANCE & RELIABILITY

Condition Monitoring System For Steam Ejector Vacuum Pumps
Andreas Kubbe, Frank Dorstewitz, Jochen Schlueter

Hear the Difference: Acoustic Plant Monitoring
Anna Mayrhofer, Franz Hartl, Adnan Huschke, Andreas Rohrrofer, Swathish Thazhath Johnce

Comprehensive Condition Monitoring for the Metals Industry
Bernhard Voglmayr, Arno Haschke, Klaus Stohl, Richard Stadlmayr, Andreas Maiervofer

Reduction of Maintenance Costs and Improved MTBR of Boiler Steam Drum and Superheat Safety Valves
Timothy Shelton, Charles Kuntz, Larry Frey

Controlling Equipment Failures Caused by Petroleum-Based Fluid Degradation
John Schlobohm

Reparation of Trusses in the Steel Plant Environment
José Geraldo de Araujo Silva, Antônio Maria Claret de Gouveia, Hisashi Inoue, Gustavo de Oliveira Daumas, Lucas Teixeira Araujo

Maintenance Practices of Gas Analyzers in the Steel Industry
Ashish Garg, Pradyot Basu

LUBRICATION & HYDRAULULICS

Solutions for Long Products Lubrication to Avoid Long Maintenance Stops
Josef Barreto-Pohlen, Tim Mattern, John Accurso, Jon Linazasoro, Bruno Sanchez

New Advancements in Condition Monitoring Technology to Enhance Steel Mill Productivity and Profitability
Toby Hlade, Timothy Hurley

New High-Performance Oil-Lubricated Gear Spindles for Algoma’s DSPC
Andrea Donadon, Gianni Tiussi, Morris Codarin, Andrea Tonnicchi, Andrea Codutti, Michele Bordignon

REFRACTORY SYSTEMS

The Use of Advanced Refractory Technology to Improve Energy and Environmental Efficiency in Steel Applications
James Hemrick

Advanced Cold Isostatic Press MgO-C Brick
Masayoshi Kakihara, Shohei Kaneko, Hisashi Tomiya, Atsuhisa Iida, Hiroki Yoshioka

Enhancement of RH Refractory Performance for Electrical Steel Processing
Santhamitra Bharati, Harsh Joshi, Prakash Patil, Basavarajuppa H K, Suryanarayan Vishwanath

Inhibition Effect of CaO-ZrO2-C Nozzles on Alumina Deposition in Continuous Casting of Al-Killed Steel
Wei Lin, Yukio Okkawa, Takayuki Matsumaga, Masakazu Iida

Impact Zone Solutions for an Improved Flow Performance in the Tundish
Gernot Hackl, Yong Tang, Gernot Lukech, Daniel Meurer, Pavan Shivaram, Alexandre Dolabella Resende

Development of Basic Gunning Mixes: Comparison of Laboratory Trials, Thermochemical Calculations and Steel Plant Trials
Ronald Lanzengberger, David Wappel, Gregor Lammer, Manuel Forrer

Gunning Manipulators for Hot Repair
Christian Wolf
MATERIAL HANDLING/TRANSPORTATION & LOGISTICS

State of the Art in Magnetic Drum Separators for Scrap ................................................................. 2877
Thomas Saccamozzone

The Case for the Eriez Separator Process .................................................................................. 2887
Thomas Saccamozzone

CRANES

Smart Crane Control Helps the Steel and Metals Industry Compete in IoT Age........................................ 2893
Thomas Foppe

Crane Remote Control From Ground Pulpit .................................................................................. 2895
Lorenzo Bacchetti

Automatic Cranes Into the Process: Reducing Bottlenecks by Empowering Logistics ......................... 2899
Lorenzo Bacchetti

The Causes and Effects of the Keys Missed in the Main Hoist Gear Reducer on the Ladle Cranes .............. 2907
Wen-Kuei Chiu

ROLLS

Optimization of Hot Rolling Roughing Mill Rolls to Prevent Premature Occurrence of Contact Fatigue Damage .................................................................................................................. 2915
Sebastien Flament, Olivier Lemaire, Gisele Walmag, Mario Sinnaeve

CRANES

Human Impact of Visual Aid Technologies in Steel Mills ..................................................................... 2927
Christopher Machut

HOT SHEET ROLLING

Temperature Setpoint Optimization in Steel Reheat Furnaces Using Open Architecture Neural Network and Modeling Software.................................................................................................................. 2929
Ricky Vesel, Justin Isaacs

DIGITAL TRANSFORMATION

Optimizing Production Efficiency and Quality with Digitalization ......................................................... 2939
Thomas Pfutzschbacher, Jan Friedemann Plaul, Wolfgang Oberaigner, Alfred Seyr

Digitally Transforming Knowledge With Mixed/Augmented Reality Tools .............................................. 2949
Eric Almquist

SAFETY & HEALTH

Comparative Analysis of Arc Flash Solutions — A Case Study ............................................................. 2957
Ramesh Khajjayam, Sonal Bhatt

ELECTRICAL APPLICATIONS

Building the First Prototype IIoT Solution for Your Power System ...................................................... 2969
Poojit Lingam, Anil Kanagala, Hiranya Pathak

Modernization of MG Set and DC Drives to AC Drives-Based Solutions - A Power Distribution and Quality Perspective ................................................................................................................... 2979
Poojit Lingam, Anil Kanagala, Roland Resch
ENVIRONMENTAL/ENERGY & UTILITIES

Energy, Exergetic and Experimental Analysis in a Motor of Internal Combustion Using as Fuel the Fluids Process of Pyrolysis Assisted by Microwave ................................................................. 2989
Luiz Filipe Cardoso de Oliveira, Tiago Luis Oliveira, Paulo Santos Assis

SAFETY & HEALTH

Active Personnel Monitoring and Access Control in Steel Manufacturing Environments ........................................ 2999
Micah K. Anderson, Allison N. Birch, Michael T. Hughes, Noah J. Sabers, Clement Lam, Travis S. Welt

METALLURGY – PROCESSING, PRODUCTS & APPLICATIONS

Heat Transfer Modeling of an Industrial Quenching Device .................................................................................... 3009
Vinicius Freitas Paixão, Lis Nunes Soares, Roberta Barros

ENVIRONMENTAL

Advances in Cooling Water Treatment for the Steel Industry .................................................................................. 3015
Brad Buecker, Ray Post, Jeremy Leitze, Mark Bush

Author Index