



**Proceedings of the
Iron & Steel Technology Conference
Volume I**

**8–11 May 2023
Detroit, Mich.
U.S.A.**



Ronald E. Ashburn, *Publisher*

Amanda L. Blyth, *Publications Manager*

Jennifer M. Vergot, *Technical Editor*

Emily C. Williams, *Technical Editor*

Carolyn A. Trobaugh, *Graphic Designer*

Beniamina Dapra, *Graphic Designer*

Kyle McMullen, *Graphic Designer*

A Publication of the Association for Iron & Steel Technology

AISTech 2023
Iron & Steel Technology Conference Proceedings
Volume I

Copyright © 2023 by Association for Iron & Steel Technology or the authoring company(ies).
Contact AIST for specific information on reprinting or repurposing any part of this publication.

All rights reserved.
Printed in the U.S.A.

ISBN: 978-0-930767-20-4 (Print)
ISBN: 978-1-7138-7355-6 (CD-ROM)
ISSN: 1551-6997

Association for Iron & Steel Technology
186 Thorn Hill Road
Warrendale, PA 15086-7528
U.S.A.
Phone: +1.724.814.3000
Fax: +1.724.814.3001
memberservices@aist.org
AIST.org

The Association for Iron & Steel Technology is not responsible for statements or opinions
expressed in this publication.

In the development, submittal and presentation of material for publication for any of the Association for Iron & Steel Technology's (AIST's) media, AIST seeks to maintain the highest standard in its service to the industry. AIST expects its members, authors and presenters to adhere to these standards within any AIST function or forum. Plagiarism within submitted work will not be tolerated. Any responsibility for the thorough investigation of work submitted for publication in AIST media lies with the author or the author's employer prior to said submission. AIST shall not be liable for any outcome related to claims of plagiarism.

Papers delivered at AIST-sponsored forums are intended to be technical in nature, with solutions supported by verifiable data. Commercially motivated commentary or endorsement of specific brands or companies is not acceptable. Each paper will be reviewed by forum organizers to ensure compliance with this policy. If a paper is deemed to be in violation, the author(s) will be notified by the forum organizer(s) and given the opportunity to revise the content or to withdraw the paper/presentation. To preserve and protect the interests of AIST, forum organizers will have the authority and the responsibility to stop any paper presentation they determine to be in violation of this policy and/or withdraw the paper from publication in conference proceedings.

TABLE OF CONTENTS
AISTech® 2023

Volume 1

HOWE MEMORIAL LECTURE

Howe Memorial Lecture

Fiber Optic Sensing Technologies Supporting Advancements in Steel Production and the Shift to Industry 4.0..... 1
Ronald O'malley

SAFETY & HEALTH

Analytics & Automation for Health & Safety

Digital Computer Vision Technologies for Safety Management in Steel Manufacturing..... 31
Roy Lan, Ibukun Awolusi, Jiannan Cai

Digital Transformation in Training & Safer Operations

Point Clouds and Interactive 3D Models for Safety Training Realism..... 43
John Moreland, Kyle Toth, Justin Heffron, Chenn Zhou

Implementing Virtual Reality Technology for Safety Training to Reduce Hand Injuries in the Steel Manufacturing Industry 47
Mohammad Nafe Assafi, Joshua Cotton, Grant Wood, Junfeng Ma, Yu Wang, Jun Wang

Operational Safety and Digital Transformation: A Win-Win Integration 58
Marco Ometto, Costanzo Pietrosanti

Planning & Implementing Safety Into the Working Area I

System Safety or Safety System — What Is the Difference? 68
Malcom Dunbar

Planning & Implementing Safety Into the Working Area II

Hazard Recognition, Risk Perceptions and Safety Climate Among Steel Manufacturing Workers 82
Luz S. Marin, Majed Zreiqat, Wanda Minnick, Gabriella Green, Chloe Croft, Sydney Sheredy, Brandon Wiggins

Real-Time Legionella Monitoring of Contact and Non-Contact Cooling Systems 92
James Gleason

ENVIRONMENTAL

EAF Gas Flow Emission & Energy Optimization

- Energy Consumption Forecast to Cash In on Profits From Short-Term Market Prices..... 94
Stefan Albers, Peter Bachmann, Rudolf Felix, Alexander Görtz, Heinz-Josef Ponten

NO_x Reduction & Carbon Emission Optimization

- SNCR Experience in an Iron Ore Pellet Plant..... 103
Fabio Ferrari, Niccolò Griffini
- Reduction of Gaseous Emissions by Applying a Spray-Scrubber-Based Process for Cyanide Compound Reduction in Blast Furnace Gas..... 108
Alessandro Olcese, Lorenzo Micheletti, Luca Spadoni, Ismael Matino, Antonella Zaccara, Alice Petrucciani, Valentina Colla, Teresa Annunziata Branca

Regulation & Emission Reduction

- The Need to Lower the Opacity Limit Following EPA Recommendations: The Experience of a Totally Enclosed Building That Operates Above an EAF with Ultralow Specific Electrical Consumption 122
Marco Peter Cudicio, Alberto Feruglio
- Flue Gas Cleaning to Optimize CO₂ Capture 128
Xavier D'Hubert

Waste Minimization & Energy Reduction

- Synthesis of Fe-Al-C Intermetallic Alloy via Fe₂O₃-Al-C Interaction at 1, 550°C: Implication for Mill Scale Upcycling..... 142
Praphaphan Wongsawan, Weerayut Srichaisiriwech, Somyote Kongkarat
- Heat Storage and Centralization in a Steelmaking Plant — A Rational Use of Energy..... 155
Gabriele Guastafarro, Antonio Sgrò, Marco Lapasin

Water Treatment & Minimizing Water Waste

- Production of Aqueous Chlorine or Bromine Using Electrohalogenation Technology for Cooling Water Microbial Control..... 166
Andrew Boal

DECARBONIZATION

Biomass Solutions

- Decarbonization Based on Sustainable Biomass in Ironmaking, Steelmaking and Ferrous Alloying: A Continuous Improvement of a Centenary Experience in Brazil..... 171
Ronaldo Sampaio, Thiago Oliveira

Biotechnologies: A Pathway to Net-Zero CO ₂ Emissions Steel?	182
<i>Maéva Chrzaszcz, Mariam Sidawi, Ian Cameron, Richard Elliott, Mitren Sukhram</i>	
Photosynthesis: A Natural Process for Decarbonization of the Steel Industry	211
<i>Dácio Calais, Ronaldo Sampaio</i>	

Green Reducing Agent Technologies

Nuclear Energy as a Pathway to Decarbonization for Modern Steelmaking Plants	221
<i>Herbert Lam, James Wikston, Neil Tannyan</i>	
Clean Hydrogen From Steel Plant Waste Gases	232
<i>Matthew Dawson, Jamal Ferguson, Ken Grieshaber</i>	

New Decarbonization Technologies

Decarbonizing the Iron and Steel Industry Under the New Energy Order	237
<i>Francesco Memoli, Claudio Galimberti</i>	
Applications of Advanced Smelting Furnace Technology for Sustainable Steelmaking	247
<i>Kyle Chomyn, Sa Ge, Terrence Koehler, Christopher Walker</i>	

Novel Decarbonization Routes

Carbon-Free Fully Electrical Soaking Furnace Designed by DCC Now Running at Fagersta Stainless.....	256
<i>Andrea Biliotti, Alessandro Venanzini, Narayan Raut</i>	

Pathway to Responsible CO₂ Standards

Decarbonization Perspectives: Assessment of Different Scenarios in the Iron- and Steelmaking Industry.....	260
<i>Thiago Oliveira, Chris Pistorius, Ronaldo Sampaio</i>	
Path to Responsible Steel Certification	272
<i>Ramon Contreras, Jimena Klaumer</i>	
Driving Demand for Green Steel Through Clean Energy Projects.....	277
<i>Caitlin Swalec</i>	
Methodology for Developing a Strategic Road Map for Reducing Energy Consumption and CO ₂ Emissions for Iron and Steel Plants	281
<i>Sunil Kumar, Yakov Gordon</i>	

COKEMAKING

Cokemaking

Technical Support to Schwelgern Coke Plant Featured by Carbonization Retort	287
<i>Marc Schulten, Viktor Stiskala</i>	

IRONMAKING

Blast Furnace Maintenance & Productivity

- Strategic Hearth Campaign Extension Strategies Using Partial Repairs 319
Jesse Carreau, F. Van Laar, R. Chaykowski, M. Grguric, Angelo Petrucci
- Campaign Life Extension of Ironmaking Facilities..... 333
Chad Van Der Woude, C. Long, Kyle Chomyn, Hamid Ghorbani

Digitalization, Control & Modeling

- Blast Furnace Hot Metal Temperature Prediction with Multi-Wave Pyrometer Measurements..... 350
Alexander Schmitz, Juraj Micak, Lijia Wu, Markus Schulte
- An Eulerian-Based Reduction Model for Iron Ore Particle Reduction 358
Markus Bösenhofer, Franz Hauenberger, Hugo Stocker, Christoph Feilmayr, Michael Harasek
- Investigating the Use of Shaft-Level Tuyere Injection with Computational Fluid Dynamics..... 366
Samuel Nielson, Tyamo Okosun, Orlando Ugarte, Chenn Zhou
- Evaluation and Improvement Methods of Preparation for a Blast Furnace Taphole Campaign..... 375
Eduardo Antônio Laia Da Silva, Alfredo Carlos Bitaraes Quintas, John Jesus Mol Peixoto, Carlos Antônio Da Silva
- Investigation of the Thermally Thick Alternative Reducing Agent Behavior in the Raceway Zone..... 381
Matthias Kiss, Markus Bösenhofer, Franz Hauenberger, Hugo Stocker, Christoph Feilmayr, Michael Harasek

Low-CO₂ Iron II

- Fuel Flexible Ironmaking with Reduced CO₂ Emissions 392
Ian Cox, Enrico Di Cesare
- A Novel Test Rig for the Evaluation of Auxiliary Reducing Agents (ARAs)..... 397
Thomas Nanz, Markus Bösenhofer, Johannes Rieger, Christoph Feilmayr, Franz Hauenberger, Hugo Stocker, Michael Harasek
- CO₂ Reduction by Combining Methanation with the Blast Furnace 404
Yuki Kawashiri, Yusuke Kashiwara, Kiyoshi Fukada

Sintering/Pelletizing/Briquettes

- Effects of Recycling Sinter Dust as Calcium Ferrite in the Sintering Process on Sinter Quality and Emission of CO₂, NO and SO₂ 424
Leonardo Tomas Da Rocha, Seongkyu Cho, Sung-Wan Kim, Sung-mo Jung
- Numerical and Experimental Approach to Heating Iron Ore with Mixed Coal 442
Prasenjit Singha, Soumya Ranjan Mohanty, Sunil Yadav, Ajay Kumar Shukla

DIRECT REDUCED IRON

DRI & HBI Handling

Effects of Making HBI with and Without Hot Fines Recycling	450
<i>Matthew Miller</i>	

Ore Quality & Use in Blast Furnaces

Industrial Trial of Recycled Iron Briquettes Produced with Iron Ore Fines and Sludge From Sedimentation Piles in a Direct Reduced Iron Reactor.....	459
<i>Erick Bubniak, Joel Morales, Andres Villa, Jose Senra</i>	

Plant Design, Safety & Maintenance

Complete Refractory Solution for DRI Reactors with High Hydrogen Concentration in the Reducing Gas	467
<i>Sangram Mohapatra, Bertrand Hiot, Bruno Touzo</i>	
H ₂ -Change: Refractories Under Attack of Challenging Atmospheres During Transformation Process	471
<i>Jens Sperber, Franz-josef Duennes</i>	
Next Generation of Pelletizing Plants for the Transition to Green Steel	480
<i>Maximilian Köpf, Matthias Gabriel, Robert Schiemann, Olavo Nolasco</i>	

Reduction Mechanisms

Circored Fine Ore Direct Reduction and the Benefits of Microgranulation	495
<i>Sebastian Lang, Maximilian Köpf, Sebastian Richter, Jan-folker May</i>	

DIRECT REDUCED IRON/DECARBONIZATION

Direct Reduced Iron/Decarbonization

Briquette Strength: Effect of Hydrogen vs. Reformed Natural Gas	503
<i>Vita A. Dean</i>	
A Low-Carbon Emission Flowsheet for BF-Grade Iron Ore Using Advanced Electric Smelting Furnace	508
<i>Sa Ge, Ezra Widajat, Takshi Sachdeva, Kyle Chomyn, Christopher Walker, Ian Cameron</i>	

ELECTRIC STEELMAKING

Automation/Neural Networking Systems

Instrumented Trial-Based Models for Efficient Electric Arc Furnace Operation	519
<i>Bikram Konar, Naveen Sundaresan Ramesh, Andrew Hamilton, Kendal Dunnnett</i>	
Dynamic Process Control and Optimization of an Electric Arc Furnace.....	531
<i>Andreas Rohrhofer, Helmut Aflenzer, Thomas Reindl</i>	

EAF Efficiencies & Improvements

Electrode Cooling Optimization.....	538
<i>Chris Barnes, Rick Toste</i>	
Large Electric Arc Furnace Equipped with Electro-Magnetic-Stirrer as a Model for the Efficient and Reliable Transition of the Steel Industry	540
<i>Silvio Reali, Andrea Grasselli, Zaeim Mehraban, Lidong Teng</i>	
EAF Revamp at Gerdau Monroe: A Case Study of EAF Capacity Increase and Its Impact on the Overall Meltshop Operation	548
<i>Rodrigo Costa, Hannes Beile</i>	
Reduction of Electrode Breakage During Operation in a 130-Ton EAF from ArcelorMittal Resende – Case Study	552
<i>Paulo Hopperdizel, Thiago Wandekoken, Hélio Espindula De Oliveira, Marssal Victorino, Iury Silva</i>	

Media Transport

The Critical Role of Hydrogen in Linde’s Coherent Jet Technology.....	566
<i>William Mahoney, Adrian Deneys, Pravin Mathur, Sumant Warty</i>	
Use of Different Lime-Based Products to Promote Agglomeration of Bio-Charcoal for EAF Injection Through Extrusion and Tableting Processes.....	577
<i>Joyce Aderhold, Mark Ford, Hugues Lambert, Helene Huynh, Jan Böhringer, Mac Steele, Bill Johnson</i>	
Lime Particle Size Variation — Effects in Lime Injection Systems	587
<i>Eric Schons</i>	

Refractory & Slag

Rapid Slag Analysis with Digital Sample Homogenization to Slag Analysis in Under One Minute and Efficient In-Situ Furnace Management.....	598
<i>M. Ounanian, B. Van Stuijvenberg, M. Ounanian, B. Van Stuijvenberg, Alexander Schlemminger</i>	
Fiber Optic Raman Probe for On-Line EAF Slag Analysis.....	603
<i>Bohong Zhang, Hanok Tekle, Ronald O'Malley, Todd Sander, Jeffrey D. Smith, Laura Bartlett, Farhan Mumtaz, Rex E. Gerald II, Jie Huang</i>	
EAF Lining and Hot Repair: New Technologies to Improve Repair Quality and Furnace Productivity	613
<i>Rubens Freire, Martin Kammerhofer, Gerhard Pusterhofer, Francisco Rangel</i>	

Robotics Applications

Automatic Robotic Solution for Internal Furnace Inspection to Optimize Cooling Panel and Refractory Maintenance	618
<i>Simone Ambrosio, Manuel Martin, Marco Ometto</i>	

"The Future Is Manless" Takes the Next Step	623
<i>Tim Steurer, Danny Schreiber, Patrick Hansert, Henning Karbstein, Matthias Breithaupt, Ralf Schweikle Schweikle</i>	

EAF Optimization: An Important Factor in Reducing Steelmaking Energy Intensity and GHG Emissions	635
<i>Douglas Zuliani, B. Babaei</i>	

COLD SHEET ROLLING

Scrap

Real-Time On-Line Elemental Analysis of Scrap for Steelmaking	647
<i>Henry Kurth, M. Kalicinski</i>	

OXYGEN STEELMAKING

A CFD Study of the Melting Process of HBI/DRI Scrap in an AC Electric Arc Furnace	655
<i>Orlando Ugarte, Neel Busa, Pavan Vemula, Tyamo Okosun, Chenn Zhou</i>	
Classification of Scrap Types Using Computer Vision Algorithms	665
<i>Abhieshree Dhami, Chirag Vaghela, A. Asaro, Dehong Yuan, G. Pravisani, Jens Kempken, Christoph Kirmse</i>	

ELECTRIC STEELMAKING

Trials & Plant Start-Ups

Use of HBI in Cleveland-Cliffs EAF and AOD Operations	675
<i>Jianghua Li, Mark Suer, Jeffrey Haeberle, Ryan Bowser, Jason Fehr, Brian Dehaut, Misty Erford</i>	
AURA Digital Feeders for Low-Impact Electric Arc Furnaces	686
<i>Luca Neri, Andrea Lanari</i>	
The Medium-Frequency Coreless Induction Furnace – A CO ₂ and NO _x -Friendly Solution for Scrap Melting	692
<i>Frank Donsbach, Sebastian Esser, Thomas Schanz</i>	
Start-Up of New Meltshop and Strip Production Plant at Nucor Steel Gallatin	705
<i>Luca Faralli</i>	
EAF Restart at ArcelorMittal Sul-Fluminense: Problems and Solutions to Reach Process Performance Goals	712
<i>Paulo Hopperdizel, Thiago Wandekoken, Arthur Ramalho, Marco Antônio Almeida, Fábio Moreira, Gerson Moraes, Igor Rana</i>	

ELECTRIC STEELMAKING/DECARBONIZATION

Electric Steelmaking/Decarbonization

Digital Solution for Optimizing Scrap Yard Management.....	723
<i>Josué Rodríguez Díez, Asier Vicente Rojo, A. Gallettebeitia, R. Jaras, G. Sorrosal, J. A. Arteché, A. Lago</i>	
Applications of Carbon Sources for Green Steel Using Power Carbon	734
<i>Breno Totti Maia, Bernardo Martins Braga, Lucas Moreira Duarte, Marcelo D. S. L. Guerra, Paulo Hopperdizel, Thiago Wandekoken</i>	
Use of Green Pig Iron in the Electric Arc Furnace	744
<i>Pedro Machado, Savia Pinheiro, Diego Santiago</i>	

OXYGEN STEELMAKING

Blowing Practice

Nitrogen Control in the Basic Oxygen Steelmaking Process	752
<i>Saikat Chatterjee, Bapin K Rout</i>	
Modeling of the “K” Compensation Factor of the Momentum Balance Equation in a Metallic Bath in the LD.....	775
<i>Willian Dos Reis Lima, Bernardo Martins Braga, Breno Totti Maia, Mauricio Covcevich Bagatini, Roberto Parreiras Tavares, Ana T. D. S. D. Moreira, Ana Luiza Vasconcelos E Silva, Pedro Henrique Araújo, Gaele Laure Siemou Tchoupo</i>	
Novel Approach to Control Nitrogen in BOF Steelmaking.....	791
<i>Akasmita Biswal, J. Hari Babu, Sujeet Kumar</i>	
Blow Ignition — Cause of Premature Failure in Lance Tip	798
<i>Breno Totti Maia, Willian Dos Reis Lima, João Paulo Mafort Santos, Bruno Orlando De Almeida Santos, Lucas Alves, João Domingos De Athayde Junior</i>	

Process Metallurgy

Skull Removal Device in Lances of BOF Process	808
<i>Emilio Acciarito Filho, Aristides A. Barbosa, Henrique A. Carneiro, Claudio Lapa, Vincent Pimpinella</i>	
Effects of Slag Removal Method on the Process Parameters of Energy Optimizing Furnace.....	813
<i>Malaiyappan Vidhyasagar, Palvannanathan Ramasubramanian, Durairaj Rajesh, Manjini Sambandam</i>	

Process Modeling

Hybrid Process Models Are Setting New Standards for Advanced Process Optimization in Converter Steelmaking	832
<i>Anna Mayrhofer, Helmut Kühböck, Krzysztof Pastucha, Bernhard Voraberger, Gerald Wimmer</i>	

Slag Splashing — Cold Model Comparisons and Equations for Industry Setup.....	845
<i>Breno Totti Maia, Willian Dos Reis Lima, João Paulo Mafort Santos, Bernardo Martins Braga, Leandro Rocha, José Roberto De Oliveira, Viktor Sinelnikov</i>	

Volume 2

Predicting the Dissolved Oxygen in Steel by Using Quick Carbon Analyzer at Energy Optimizing Furnace	862
<i>Malaiyappan Vidhyasagar, Palvannanathan Ramasubramanian, Durairaj Rajesh, Manjini Sambandam</i>	

Physical Modeling of Hot Metal Desulfurization Through Submerged Rotative Lance	876
<i>Daniela Perasoli, Cecília Laia Da Silva, Carlos Berlini Filho, Mylla C. D. S. E Silva, Johnne Jesus Mol Peixoto, Carlos Antônio Da Silva</i>	

ELECTRIC STEELMAKING

Scrap

Heat Transfer in a BOF Converter.....	884
<i>Nirmal Madhavan, Geoffrey Brooks, M Akbar Rhamdhani, Bapin K Rout, Aart Overbosch</i>	

SPECIALTY ALLOY & FOUNDRY/METALLURGY — STEELMAKING & CASTING

Specialty Alloy & Foundry/Metallurgy — Steelmaking & Casting

Investigation of Non-Metallic Inclusions During Primary Melting of Specialty Steels	901
<i>Andrew Huck, Bryan Webler</i>	
New AOD Automation System at Cleveland-Cliffs Butler Works	911
<i>Mark Suer, Jacob Brocklehurst, Kevin Allen, Dale Shandick, Ryan Bowser</i>	
Metal Degassing by Means of Vacuum Cap (VCAP) Technology for Enhanced Material Properties	926
<i>Iñaki Vicario, Aaron Teske, Eike Schmilinsky, Martin Myška, Roman Ritzenhoff</i>	

Vision & Data Analytics/Machine Learning

Bubble Size Determination in a Half-Scale Curved Water Model Mold for Various Casting Conditions Using Imaging and Machine Learning.....	934
<i>Soumitra Kumar Dinda, Donghui Li, Fernando Guerra, Chad Cathcart, Mansoor Barati</i>	
Bubble-Inclusion Interaction During Argon Bubbling in a Tundish: Assessment with Automated Inclusion Microanalysis and Data Analytics	945
<i>Thiago Oliveira, Chris Pistorius, Mauro Ferreira, Dai Tang</i>	
Quality Improvements in the Vacuum Degasser by Steel Exposure Model Through Artificial Vision	959
<i>Richard Marquez, Esnardo Morales, A. Alvarez, R. Lescas, D. Alvarado</i>	
Steel Works Energy-Saving Strategies Through Artificial Intelligence Techniques.....	967
<i>Esnardo Morales, Richard Marquez, A. Alvarez</i>	

Physical and Mathematical Modeling of Residence Time Distribution and Grade Transition in a Twin-Strand Slab Caster Tundish	976
<i>Soumitra Kumar Dinda, Donghui Li, Fernando Guerra, Chad Cathcart, Mansoor Barati</i>	
Modeling of the Mixing Phenomena in the RH Vacuum Refining Process.....	986
<i>Franz Ramstorfer</i>	

SPECIALTY ALLOY & FOUNDRY/METALLURGY — PROCESSING, PRODUCTS & APPLICATIONS

Specialty Alloy & Foundry/Metallurgy — Processing, Products & Applications

Casting Configuration Development for Improved Performance Solutions of Walking Beam Furnace Components	998
<i>Tanya Ros-Yanez, Elia Scotuzzi, John Martin, Barry Felton, Federico Prandi, Brian Shaw Shaw</i>	
Control of MnS Inclusion Aspect Ratio in Lead Free-Cutting Steels	1010
<i>Soorya Prakash Jayaraj, Vetrivelmurugan R, Mohammed Rasul Iqbal, Manjini Sambandam</i>	

LADLE & SECONDARY REFINING

Modeling & Machine Learning I

Modeling EAF Carryover Slag Volume and LMF Lime and Ca-Aluminate Addition	1021
<i>Dai Tang, Collin Scott, Jose Lara, Chris Pistorius</i>	
A CFD Study of Alloy Dissolution and Homogenization in the Ladle Metallurgy Furnace	1027
<i>Ogochukwu Duruiheme, Xipeng Guo, Nicholas Walla, John Lowry, Chenn Zhou</i>	

Modeling & Machine Learning II

Machine Vision System to Optimize Stirring During Secondary Refining Processes.....	1042
<i>Johnny Mantoani, Federico Bianco, Mauro Meneghin, Manuele Piazza</i>	
Usage of CaO-Al ₂ O ₃ Synthetic Slag on EAF Tapping for Steel Desulfurization	1050
<i>Lucas Da Silva Renato, Raphael Mariano De Souza, Victor Dos Santos Dagostini, Estéfano Vieira, Felipe Fardin Grillo, Jean Carlo Camasmie De Paola, José Roberto De Oliveira</i>	
Data-Driven Model for On-Line Steel Temperature Prediction to Optimize the Secondary Refining Processes	1062
<i>Manuele Piazza, Giulio Planu, Marco Ometto</i>	
Modeling Ladle Slags Using a Mass Balance Approach and Integration Into the Ladle Furnace Process Supervisory System.....	1070
<i>Francisco Lopez, Dickson Souza, Sabrina Matos, Tatiane Alcântara, Nicholas Silva, Neivson Carvalho, Tito Coelho, Miguel Bock, Eric Almeida</i>	

IRONMAKING

Slag & Process Optimization

- Improved Measurement System and Its Contribution to Enhanced Chemistry Control..... 1079
Paul Wu, Gregory Newman, Kevin Allen

LADLE & SECONDARY REFINING

- Safety and Operational Improvements After Installation of an Automatic Gas Coupling System 1085
Christoph Schöggel, Martin Leber, Zachary Stroman
- Increasing of LF Performance by Controlling the Slag and Steel Oxygen Activities..... 1095
Fuat Erkan Tekin, Eyüp Tan, Serdar Erdemis, Rüstem Çagri Ünzal, M. A. Türker Yurt, Sezer Arabacı, Evren Arikan, Isa Keskin, Baran Dogan

LADLE & SECONDARY REFINING/METALLURGY — STEELMAKING & CASTING

Kent D. Peaslee Memorial Session

- A Possible Reason Why Ti-SULC Grades Are More Prone to CC Clogging Issues Than Other Al-Killed Grades.....1106
Jean Lehmann, Didier Huin, Guillaume Stechmann, Amico Settefrati, Emmanuel Lucas, Jean-Francois Domgin, Francois Stouvenot
- Different Approaches to Trace the Source of Non-Metallic Inclusions in Steel.....1115
Kathrin Thiele, Sergiu Ilie, Roman Roessler, Christoph Walkner, Thomas C. Meisel, Thomas Prohaska, Susanne K. Michelic

Steel Cleanliness

- Steel Cleanliness Comparison Between Al-Killing and Al+CaC₂-Killing for Low-Carbon Steel Grade1122
Savia Pinheiro, Pedro Machado, Diego Santiago, Ricardo Rodrigues, Laurent Chessret, Aurelien Fabas

LADLE & SECONDARY REFINING/REFRACTORY SYSTEMS

Secondary Refining & Flow Control Refractories

- Ultralow-Carbon MgO-C Refractory Bricks for Special Steel Production Processes1130
Sérgio Luiz Cabral Silva, Sérgio Eustáquio Soares, Edmilson Dias Gonzaga, Laura Falco Paiva Carvalho, Sophia Vieira Macedo
- Development of New Refractories Raw Material for Slide Gate Plate1139
Keiichirou Akamine, Taro Makino, Kiyoshi Goto, Katsumi Morikawa, Kazuo Itoh
- Use of 3D Laser Scan in RH Degasser to Enhance Refractory Performance Analysis in Critical Areas.....1150
Raphaella Araujo, Leandro Silvino Crivellari, Bruno Cesar Calazans De Andrade, Wellington Moraes, Gilvan Nascimento De Souza, Julia Macedo, Bruno Laidens, Giovanni Coimbra, Leandro Martins

Lightweight, Slim Submerged-Entry Nozzle for Medium- and Thin-Slab Continuous Casting	1157
<i>Hiroyasu Niitsuma, Takayuki Matsunaga, Toshio Horiuchi, Xiaodong Li</i>	

CONTINUOUS CASTING

Bloom & Billet Casting

Initial Experience with New Round Caster Operation and Improvements at U. S. Steel - Fairfield Works.....	1163
<i>Rudolf Moravec, William Schlichting, John Ruf, Fred Mamtooth</i>	
Continuous Casting of Octagonal Section Revisited: Quality Steel Production Trials at Acciaierie Bertoli Safau S.p.A.....	1172
<i>Pierluigi Armenante, Przemyslaw Remigiusz Pardela, Marco Truant</i>	
World's Largest Casters are Danieli's in China	1183
<i>Pierluigi Armenante, Yuanqing Chen, Marco Mauro Motta, Przemyslaw Remigiusz Pardela, Thierry Gautreau, Aymeric Chemin</i>	

OXYGEN STEELMAKING

Caster Modeling

Sensor Instrumentation and Advanced Imaging of the Full-Scale Physical Twin Mold for Digital Data Generation During Continuous Casting	1194
<i>Jackie Leung, Soumitra Kumar Dinda, Donghui Li, Joydeep Sengupta, Markus Bussmann</i>	

CONTINUOUS CASTING

Flow Simulation Approaches and Supplementary Measurements for SEN Design Characterization and Its Development.....	1204
<i>Gernot Hackl, Wolfgang Fellner, Yong Tang, Tianfei Ma, Pavan Shivaram</i>	
Thin-Slab Caster Mold Thermal Mapping: An Advanced Solution for High-Efficiency Sticking Detection	1213
<i>Riccardo Conte, Giovanna Busolin, Andrea Zamolo</i>	

Caster Mold Fluxes

Mold Powder Development for High-Al Medium-Carbon Steel Continuous Casting	1221
<i>Daisuke Katayama, Junya Ito, Erika Nakatani, Masanori Okada, Jim Gilmore</i>	
The Study of the Behavior of CaO-SiO ₂ -Al ₂ O ₃ -Na ₂ O-Based Mold Flux in 1, 400°C by a Fiber-Optic Raman Sensor	1227
<i>Bohong Zhang, Hanok Tekle, Ronald O'Malley, Todd Sander, Jeffrey D. Smith, Laura Bartlett, Farhan Mumtaz, Rex E. Gerald II, Jie Huang</i>	

Caster Process Improvement

Robotic System for Continuous Casting Operations	1238
<i>Ion Rusu, Anna Zoppirolli</i>	

Celsa Group Green Steel: Every Degree Counts	1243
<i>Ben Hale, P. Hughes-Narborough, G. Humphrey, Isa Keskin, S. Simmons, Ana Hernández Rivera, S. Nacarino</i>	
Next-Level Self-Adaptive Unsteady Bulging and Clogging Compensation Using the Mold Influx.....	1254
<i>Veit Humer, Ferencz Bordas, Markus Nolan, Peter Wimmer, Christian Froehlich, Michael Speher</i>	
Anomaly Detection Using the Isolation Forest Algorithm: Application to Continuous Slab Casting	1263
<i>Franz Ramstorfer</i>	

Caster Secondary Cooling

Improving Bearing Service Life in Continuous Casters	1273
<i>Robert Loughery</i>	
Is It Possible to Cast Bloom and Beam Blanks with the Same Secondary Cooling Setup?	1284
<i>Daniela Fatima Gomes, Bernardo Martins Braga, Roberto Parreiras Tavares, Mauricio Covceovich Bagatini, Carlos Berlini Filho, Gabriela Pereira Maciel</i>	

Casting Quality

Transverse Slab Crack Reduction in Low-Carbon, Low-Alloy Steels	1298
<i>Paul Wu, Mark Suer, Timothy Charatan</i>	
Slab Surface Cracking Characterization of Hyperperitectic Steels	1305
<i>Jing Su, Bikram Konar, Michael Gaudet, Andrew Hamilton, Muhammad Arafin</i>	
Investigation of Argon Bubble Injection in Continuous Casting	1316
<i>Mingqian Wang, Armin Silaen, Bikram Konar, Shaojie Chen, Chenn Zhou</i>	

Tundish Technology

Distributed Temperature Monitoring of Tundish Refractory Lining Using Optical Fiber Sensors	1331
<i>Hanok Tekle, Muhammad Roman, Rex E. Gerald Ii, Ronald O'Malley, Jie Huang, Todd Sander, Jeffrey D. Smith</i>	
Tundish-to-Mold Refractory Solutions for a MIDA Caster.....	1343
<i>Pavan Shivaram, Pedro Domingos, Gerard Mckillen, Alexandre Resende, Richard Komanecky, Jeremy Stickan, Preston Barrett</i>	
Inclusion Density in Tundish Zones Using Fluid Flow Simulations	1352
<i>Demetrius Ruy, Jose Eduardo Pereira, Lucas Meneghel, André Oliveira, L. P. Prandi, A. A. S. Beloti Beloti, Estéfano Vieira</i>	
Avoiding Asymmetric Flows Caused by Off-Center Pouring Into the Tundish: A Novel Impact Pot Design.....	1363
<i>Alexandre Resende, Rubens Freire, Gernot Lukesch, Gernot Hackl, Daniel Meurer</i>	

CONTINUOUS CASTING/HOT SHEET ROLLING

Continuous Casting/Hot Sheet Rolling

Modernizations and Upgrade Concepts of American Mini-Mills.....	1373
<i>Cosimo Cecere, Keith Watson, Björn Kintscher, Tristian Töpfer-bergner</i>	
Latest Achievements with Endless Casting and Rolling Technology at Shougang Jingtang.....	1382
<i>Alessandro Pigani</i>	
A New Era of Thin-Slab Casting and Rolling	1388
<i>Cosimo Cecere, Keith Watson, Björn Kintscher, Tristian Töpfer-bergner</i>	
Steel Producers Overcome the Gap Between Productivity and Quality Demands with Arvedi.....	1396
<i>Andreas Jungbauer, Simon Grosseiber, B. Linzer</i>	

HOT SHEET ROLLING

Digitalization

Turn-Up/Down Improvement During Roughing Mill Rolling Process at AM/NS Calvert Hot Strip Mill.....	1402
<i>Ayumu Wagatsuma, Betts Tania, Gleyson Barbosa, Alec Glenn</i>	
Benefits of Usage of Various Models in a Hot Strip Mill.....	1410
<i>Eugene Nikitenko</i>	
Development of Tandem Steering Control in Hot Strip Mill.....	1419
<i>Sanga Takagi, Satoshi Ueno, Tatsuya Tsukamoto</i>	

Energy Optimization, Green Steel, Environmental, Safety & Health

Advanced Operational Control of a Reheat Furnace with Laser-Based Combustion Feedback.....	1428
<i>Jonathon Richards, Eric Huelson, Guillaume Tiffon</i>	
Toward Lights-Out Factory: Improved Finishing Mill Operation by Centerline Control, Reduced Strip Steering.....	1438
<i>Klaus Pronold, Alexander Kofler, Christian Mengel, Guido Eichert</i>	

Maintenance & Reliability and Continuous Casting

Effect of Water Jet Nozzle Lead Angle on Descaling Efficiency	1445
<i>Tochukwu Princwill Ojiako, Viraj Athavale, Richard Osei, Taha Tayebali, Oldair Sasso, Mario Buchely, Laura Bartlett, S. Lekakh, Ronald O'Malley</i>	
Strip Steering Control in a Hot Strip Mill as a Key Feature for Safe and Stable Production	1455
<i>Klaus Loehe, Sebastian Kallabis, Niklas Petrasch, Andreas Maierhofer</i>	
Cladded Downcoiler Pinch Rolls: New Alloys and Improvements Achieved.....	1462
<i>Michal Zawadzki</i>	

DIGITALIZATION APPLICATIONS

Quality

- Rectifying a Misinterpretation on Gaugemeter Automatic Gauge Control (AGC) Model 1466
Yuli Liu
- How the Virtualized Modernization of a Hot Strip Mill Control System Led to Improved Quality
for thyssenkrupp Steel Europe..... 1474
Karola Gurrath, Matthias Kurz, Andrea Schmidt, Klaus Loehe, Raphael Twardowski

COLD SHEET ROLLING

Latest Advancements in Steel Processing

- Eco Pickled Surface (EPS) Technology Evolution: Next-Generation Cell Design, System
Integration and Application to High-Strength and Silicon Steels 1491
Christopher Liefer, Alan Mueth, Kevin Voges
- Latest Developments in On-Line Monitoring of the Condition of Steel Cold Rolling Emulsions 1506
Mike Cook
- An Examination of the Underlying Physics and Mechanics of Herringbone and Diagonal/Cross-
Buckle Flatness Distortions — Part 2: Analytic Analysis of Planar Shear-Induced Diagonal
Wrinkles 1512
Mark E. Zipf
- Defect Logging in Steel: The Speech-to-Text Way 1522
*Anil Kumar Pujari, Anurag Kallakuri, Arghya Chatterjee, Samagra Kumar, Achinta Dalal,
Nitish Kumar, Niladri Paul*

DIGITALIZATION APPLICATIONS

Rolling Innovation

- Coolant Demands for Silicon Steel Cold Rolling 1526
J. B. A. F. Smeulders

COLD SHEET ROLLING

- Maximizing Yield Using Innovation in Automatic Gauge Control for Rolling Mills 1539
Navneet Singh, John Bartlett, Manish Kumar
- Tatmetal Rolling Innovation..... 1548
Tommaso Settimo, Dmitriy Voitekhovskii
- 6-High Cold Rolling Mill (HYPER UC-MILL) with Smaller Work Roll Diameter for Thin-Gauge
Rolling..... 1554
*Akihiro Yamamoto, Shinichi Koga, Yu Kojima, Shin Ozeni, Takehiko Saito, Yuta Shiga, Keng
Hoo Lam*

Technology & Silicon Steel Rolling

Confocal Technology: The Next Generation in Optical Thickness Gauging.....	1565
<i>Achim Sonntag, Nicolas Dreihäupl</i>	
How to Make an Old 4-High Cold Rolling Mill Fit for AHSS or Electrical Steel Production.....	1571
<i>Konrad Krimpelstaetter, Sebastian Angerer, Bernhard Schinagl</i>	
Effective Cold Rolling Technologies for the Successful Production of Electrical Steel and AHSS.....	1578
<i>Konrad Krimpelstaetter, Roland Kellermayr, Helmut Dagn, Josef Hofbauer</i>	
New Contactless Flatness Measurement for Improvement of Strip Quality and Production Yield.....	1590
<i>Simon Hain, David Terry, Andreas Maierhofer, Claudio Blanco De Souza</i>	
Effect of Dewpoint on the Evolving Spectral Emissivity of Advanced High-Strength Steel During Intercritical Annealing.....	1598
<i>Fatima Suleiman, Nishant Narayanan, Kyle Daun</i>	

GALVANIZING

New Processing Technologies for Galvanizing

Redundant Strip Temperature Measurements on a Continuous Galvanizing Line	1608
<i>Robert Comstock, Kevin Ward, Joyce C. Niedringhaus</i>	
Laser Ultrasonic Inspection of Mash Seam Welds in a Steel Mill.....	1616
<i>Morgan Hiraiwa, Hao Guo, Alexandre Nadeau, Andrew Grasley, Matthew Stautz</i>	
Double-Shell-Type Oven Design for Coil Coating Line to Optimize On-Site Erection Activities, Fan Energy Consumption and Lifetime.....	1625
<i>Michele Chiappa</i>	

New Technologies in Galvanizing

Approach to Successful Development of Low-Carbon, Lean-Alloyed Cold-Rolled Galvanized HSLA 550 Sheet Steels	1628
<i>Shobhit Bhartiya, Siddhartha Biswas, Bilin Chen, Codrick Martis, Yash Injeti, Mat Bishop Bishop, Ana Araujo, Amar De</i>	
Effect of Zn-Bath Temperature on the Corrosion Behavior of Martensitic Steels 1.4095, 1.4096 and 1.4097 in Comparison to the Ferrite-Free Austenitic Steel 316L	1636
<i>Tobias Simon, Frank Wischnowski</i>	

Volume 3

Arvedi Servola (Italy) and the Production of Sustainable and Green Steel	1645
<i>Massimiliano Svetina, Walter Donato</i>	
Color-Coated Purlins Used for Pre-Engineered Buildings	1650
<i>Navneet Singh, Deepak Khanna</i>	

PLATE ROLLING

Plate Equipment Upgrades & Optimized API Skelp Production

- Application of API 5L X65M Skelp with Accelerated Cooling to Small-Diameter Spiral Pipes 1656
Qiulin Yu, Matt Montgomery, Phil Baker, Pepper Vance, Gowtham Ganesan
- Optimum Metallurgical Processing of Cost-Effective API Grade Structural Steel for Standard, Sour
and Gaseous Hydrogen Service Transmission Line Pipe Applications 1666
David Jarreta, Doug Stalheim
- Phase 1 of Plate Mill Upgrades at JSW Steel Texas Are Completed 1678
Enrico Zambon, Matteo Remy Bulfone
- Influences for the Quality of Heavy Plates After Heat Treatment 1683
Holger Kehler, Mike Allan

Plate Processing & Toughness Properties Enhancements

- Hot Rolling Roughing and Finishing Reduction Balance for Heavy-Gauge X80 1689
Michael Gaudet, Jing Su, Muhammad Rashid, Muhammad Arafin
- Surface Quality Management and Condition Monitoring to Ensure Reliable Quality Decisions..... 1700
Gregory Gutmann, M. Hoenen
- Low-Carbon High-Toughness Steel for Tank Car Applications 1706
Tanya Ros-Yanez, Susan Glinski, Michael Kapustin, Venkata Challa
- Development of a Digital Twin for the MULPIC at SSAB Mobile Plate-Steckel Rolling Mill 1715
Ian Robinson, Dengqi Bai, Yufeng Wang, John Hinton

LONG PRODUCTS

Digitalization & Project Technologies

- Process Control with a Focus on Surface Quality in Wire Rod Rolling 1725
Zhiguo Han, Enrique R. Frixione, Tzyy-shuh Chang
- Methods for Model-Aided In-Line Measurement and Control of Cross-Sections in Wire Rod and
Bar Mills 1735
Christian Overhagen, Rolf Braun
- Computer Vision Improves Safety and Productivity in Long Product Rolling Mills 1748
Miguel Vilariño, Evangelos Papadimitriou
- Roller Hearth Heat Treatment at the Cutting Edge of Technology 1757
Erik Koenig, Mike Allan

Metallurgy & Profile Measurement

- Profile Measurement of Reinforcing Bar and Rolling Defect Detection During Production 1762
Johann Peters

Intelligent Sensor for Rib Profile Detection in High-Speed Rebar Mill..... 1765
Vinit Shah, Parthasarathy Satish Kumar Bangalore, Pankaj Kumar, Abhishek Raj, Vasanth Subramanyam

Prediction of Austenite Grain Size Evolution in Wire Rod Rolling 1768
Mohammed Rasul Iqbal, Soorya Prakash Jayaraj, Manjini Sambandam

Technology Overview & Mill Upgrades

Intelligent Guides Implementation at Nucor Steel Sedalia..... 1774
Jon Ball, Christopher Hines, Eric Svensson

Equipment Technologies for Processing of Long Rolled Products 1778
Norbert Asamer

Billet Welding Machine – Latest Development Description and Real Application Results 1787
Virginio Pometto, Giuseppe Tobanelli

AI-Supported Material Simulation of Forming Processes..... 1798
Michael Kruse, Doris Wehage

PIPE & TUBE

Product & Quality Development in Pipe & Tube

Production of X70 Helical Line Pipe with Increased Gauge 1806
Michael Gaudet, Jing Su, Muhammad Rashid, Kendal Dunnett, Muhammad Arafin

ROLLS

Roll Manufacturing/Performance

On the Performance and Surface Quality of Graphitic HSS Roll Grades at Tata Steel's Direct Sheet Plant..... 1818
Michael Aigner, Danny Beentjes, Henk Bolt, Armin Paar, Leonel Elizondo

Investigation and Analysis of Mill Roll Surface After Operation to Develop High-Performance HSS Work Rolls for Hot Strip Mills 1828
Akira Noda, Nozomu Oda, Yasunori Nozaki, Paul Fleiner

Roll Shop Equipment/Processes

Tungsten Carbide: An Alternative to Chrome Plating on Work Rolls 1837
Michael Brennan, Adam Smith

New Developments in Electrical Discharge Texturing..... 1847
Chris Childs, Grant Mcbain

Electrical Discharge Texturing — How the Use of Linear Motors Will Increase the Quality of Cold-Rolled Steel Strip..... 1857
Mike Nitschke

METALLURGY — STEELMAKING & CASTING

Inclusion Study & Control

- Improvement of CpK of High-Strength Rebar Grade at New Bar Mill, Tata Steel..... 1866
Vinit Shah, Parthasarathy Satish Kumar Bangalore, Pankaj Kumar, Abhishek Raj
- Mechanism of Initial Nozzle Clog Deposit Growth and Its Countermeasure During Continuous Casting of Ti-Added Ultralow-C Steel 1873
Youn-Bae Kang, Joo-hyeok Lee
- Inclusion Control in High-Carbon Wire Rod Coils 1880
Sethu Prasanth Shanmugam, Eswarakrishnan Ramamurthy, Sakkiah Dharmar, Durairaj Rajesh

Thin-Slab Casting

- Nitrogen Composition and Its Effect on Magnetic Properties of Simulated Twin-Roll Cast Non-Grain Oriented Si Steel..... 1885
Hunter Parrish, Mario Buchely, Ronald O'Malley, Viraj Athavale, P. Kelly
- The Future of Endless Strip Casting and Rolling: Green and Designed for Automotive Exposed..... 1893
Riccardo Conte, Andrea Carboni
- State of the Art in Electromagnetic Devices for Mold Fluid Dynamics Control Presently Installed on Thin-Slab Casters 1900
Gabriele Paulon, Thierry Gautreau, Aymeric Chemin, Marco Petronio, Andrea Codutti
- Root-Cause Analysis and Control for Transverse Edge Cracks in Niobium Bearing Steel Grades Produced Through Thin-Slab Caster 1906
Ayushi Bhandari, Shainu Suresh, Alok Kumar, Uttam Kumar, Avtar S. Saini, Ravindra V. Sangwai, Vinay Mahashabde

METALLURGY — PROCESSING, PRODUCTS & APPLICATIONS

Electric Steels & Corrosion

- In-Situ Observation of the Solidification of X70 Steel Using High-Temperature Confocal Scanning Laser Microscope 1914
Katelyn Kiser, Viraj Athavale, Laura Bartlett, Ronald O'Malley, Mario Buchely
- Development of Non-Linear Equations for Predicting Electrical Conductivity in Silicates 1930
Patrick Dos Anjos, Lucas De Almeida Quaresma, Marcelo Lucas Pereira Machado
- Ensuring Highest Quality Standards in Electrical Steel Production Combining 2D and 3D Inspection Technology for Surface Defects and Waviness Recognition..... 1938
Gregory Gutmann, S. K. Weigelt

Microalloy & Characterization

- MicroNiobium-Low-Manganese Steelmaking Approach at Gerdau Ouro Branco..... 1942
Ana Araujo, Steven Jansto, Jorge Adam Cleto Cohn, Ricardo José De Faria, Altair Lúcio De Souza, Antonio Gorni, Marcelo Rebellato

Dynamic Recrystallization Behavior of a Ni-Containing Austenite-Based Fe-Mn-Al Steel..... 1950
Rogério Antao Cordoso, Michael Piston, Mario Buchely, Laura Bartlett

Characterization of Steel Plates for Sour Service Pipelines for the Improvement of DWTT Results 1962
Daniel Matsubara, Cynthia Castro, Clelia Oliveira, Ricardo Carvalho, Paulo Haddad

Thermomechanical Processing & Heat Treatment

Effects of Atmosphere on Bright Annealed Stainless Steel 1975
Jerry Arnold, Kenneth Peter

Effect of Cr and Cooling Rates in Hypoeutectoid Steels Under Forced-Convection Conditions..... 1986
Monserrat López-Cornejo, Hector Javier Vergara-hernandez, Jose Roberto Hernández Trejo, Julio Augusto Cortes-javier, Paulina Gutiérrez -gonzalez

Slipper-Type Spindles — Latest Developments and Installations for Heavy-Duty Applications..... 1994
Stefano Puzzo, Gianni Tiussi

Investigation of Thermomechanical Process Routes, From Rolling Mill to Final Heat Treatment, for the Production of Steel for Fasteners and Bolts..... 2008
Andrea Spadaccini, Sara Marzio

ENERGY & UTILITIES

Process Optimization & Innovation to Meet Decarbonization

How Modern Combustion Systems Address Top-Tier Issues for Processing Lines 2017
Dennis Quinn

Optimization of Steelmaking Gas Distribution Using an Artificial Intelligence Tool 2021
Arthur Farah, Fernanda Drumond, Kássio Cançado, Lis Soares, Ricardo Giacomini, Thiago Maia

Reheating Technologies for Decarbonization & Panel Discussion

Decarbonization and Increased Productivity in the Reheating Furnace Using Hydrogen Fuel 2033
Anurag Karambelkar, Chukwunedum Uzor, Nicholas Walla, Armin Silaen, Lawrence Fabina, Kurt Johnson, Chenn Zhou

Tenova Ultralow-NOx Regenerative Burners Working with Hydrogen and Oxygen Enrichment 2044
Davide Astesiano, Alessandro Della Rocca, Claudio Leoncini

ELECTRICAL APPLICATIONS

Electrical Applications

Application of a Less Flammable Ester Liquid in Electrical Arc Furnace Rectifier Transformers 2054
Michael Sauer, Jinesh Malde, Anthony Coker, Gary Urso

Grid-Forming Control Functionality for STATCOMs in Steelmaking Applications 2061
Jon Rasmussen, Carl-Johan Elm

Nucor Steel–Indiana Reducing/Tempering Mill Modernization	2071
<i>Thomas Richards, Devin Reed</i>	

DIGITALIZATION APPLICATIONS

AI & Machine Learning I

Model-Assisted Labeling Deployment — Enablers for AI and IOT Paving Modern Iron- and Steelmaking	2079
<i>Adnan Husakovic, Ali Abbas, Andreas Melcher, Anton Tushev, Thazhath Johnce Swathish</i>	
Adopting Machine-Learning-Based Workflows for Reducing Production Risk and Cost	2086
<i>Pamir Ozbay, Carter Almquist</i>	
Business Continuity and Cybersecurity: Using ISO 62443 Industrial Cybersecurity Standard Compliance on the Operational Technology at Çolakoğlu Metalurji	2101
<i>Michael Pillwax, Ugur Dalbeler, Özgür Özsoy, Özcan Söke, Evrim Eroglu, Serkan Cerman, Merim Cato</i>	
“Hands-Free” Fully Autonomous, Plant-Scale, Anomaly Detection AI	2112
<i>Joe Porter, Keval Bhanushali, Dan Kearns, Nikunj Mehta</i>	
Fast or Low-Speed Measurements: What Is the Best Choice for Industrial Processes?	2124
<i>Didier Morice, Geraldo Ferreira, Roelf Van Rensburg, Cesar Melendez</i>	

AI & Machine Learning II

Dancing with the Cloud.....	2133
<i>Pedro Ruiz, Gustavo La Cruz</i>	

AI & Machine Learning III

AI/ML Modeling Using Metals Industry Domain Knowledge.....	2138
<i>Franck Adjogle, Hardik Chinoy</i>	
Digital Transformation: System and Data Architecture as the Backbone for AI/ML in the Metals Industry.....	2151
<i>Franck Adjogle, Sai Parvathaneni, Jason Lenox</i>	
Industrial AI: From Myth to Commodity	2162
<i>Luc Van Nerom, Robert Jäger</i>	

Melting & Casting

Application of Tailored Scheduling Algorithms for Automated Slab Yard Management.....	2166
<i>Mansur Ahmed, Hermann Schnitzler, C. Andreas Klein, Jochen Neuer, Franck Adjogle</i>	
Customer Portal — All Information on Contract Performance in One Place	2178
<i>Mateus Assis, Ramon Fraga, Carlos Lamare, Carla Saliby, Paulo Vinicius Conceição</i>	
Digital Twin of a Torpedo Ladle: The Simulated Future	2188
<i>Bruno Luchini, Maria Gabriela Garcia Campos, Paul Van Beurden, Sido Sinemma</i>	

Digital Twin Software for a Continuous Caster.....	2194
<i>Kyle Toth, Aleeha Zafar, Xibin Zhou, Rayhan Zaman, Nicholas Gregurich, Lidia Yakovleva, Chenn Zhou</i>	

Quality

Expert System Process Monitoring and Real-Time Event Forensics	2204
<i>Franck Adjogble, Hardik Chinoy</i>	
Configurability in Service-Oriented and Collaborative Production Management.....	2219
<i>Akriti Malla, Jörg Hackmann</i>	

HOT SHEET ROLLING

Real-Time Defect Prevention in Continuous Casting.....	2225
<i>Phillip Oliver Hänisch, Baibhab Dutta, Rashmi Murthy, Christoph Kirmse</i>	

DIGITALIZATION APPLICATIONS

Rolling & Finished Goods

Improving Automatic Surface Inspection Performance by Multiple Synchronized Views and Enhanced Classification Algorithms	2234
<i>Gregory Gutmann, D. Recker</i>	
Digital Solutions for the Hot Strip Mill: Leveraging Industry 4.0.....	2238
<i>Gary Gepitulan, John Mcmillen, Paul Jackson, Justin Hollingsworth</i>	

SENSORS

Laser Sensors for Steel Production

Increasing Sustainability Through Process Optimization with the Aid of Laser Surface Velocimeters	2253
<i>Robert Bodamer, Peter Nawfel</i>	
Facilitating the Operator’s Life: How Computer Vision-Based Digital Assistants Can Improve Plant Production	2263
<i>Jens Frenzel, Christian Horn, Martin Kerschensteiner, Karsten Knothe, Alexander Thekale, Dominik Wassermann</i>	

Sensors for Safety & Process Improvements

Energy-Saving Virtual Sensor for Electric Heating Applications.....	2271
<i>Peter Sherwin</i>	

PROJECT & CONSTRUCTION MANAGEMENT

Project & Construction Management

Pre-Outage and Off-Line Testing — Mitigating Risk in Outages	2277
<i>Nicole Altman, Zach Bloede, Katherine Brosky, Thomas Ruffner, Neil Tannyan</i>	

U. S. Steel – Gary Works Pig Iron Caster: Executing a Fast-Track Project in a VUCA Environment	2286
<i>Sean Mccann, Corey Moreau, David Ploskina, Shane Smith, Rehan Arif, Neil Tannyan, Brian Black, Emerson Evangelista, Mark Winter, Alec Davis, Matthew Preuss</i>	

MAINTENANCE & RELIABILITY

Innovation in Plant Monitoring & Reliability

New, Reliable Plant Supervising System Reduces Unplanned Downtime and Eases the Plant Service.....	2306
<i>Arno Haschke, Andreas Maierhofer</i>	

An Innovative Approach to Plant and Process Supervision in Steelmaking Plants.....	2314
<i>Marco Ometto</i>	

Lubrication Solutions for a Proactive Maintenance Program

How to Escape From the Lithium Grease Price Trap	2319
<i>Tim-Oliver Mattern, Dustin Greiner</i>	

Reducing Operational Costs by Specialized Grease and Testing.....	2322
<i>Dustin Greiner, Tim-oliver Mattern</i>	

Managing Risk Applications with Analytic Information

Digital Twin in Continuous Casting Machine — Ternium Use Case	2329
<i>Leandro Passos, Rodrigo Pereira, Fábio Lourenço</i>	

REFRACTORY SYSTEMS

New Development of Steel/Iron Ladle Refractories

Energy-Efficiency Refractory Bricks for Steel Ladle Linings.....	2336
<i>Carlos Pagliosa, José Alvaro Sardelli, Bárbara Borges De Melo, Marcelo Borges, Celio Cavalcante, Enrique Mejia Mejia</i>	

Operation of Steel Mill Ladle Pre-Heater with 100% Green Hydrogen and Zero CO ₂ Emissions.....	2344
<i>Itsaso Auzmendi, Juan Blanco-requesens</i>	

Zero-Carbon Tempered MgO – ZnO Brick as Alternative of Fired Magnesia Chrome for Safety Lining of Stainless Steel Ladle.....	2353
<i>Bárbara Borges De Melo, Carlos Pagliosa, Arilton Junior, Carlos Lares</i>	

Development of a Methodology for Life Cycle Assessment of Refractories and Fluxes Used in Iron and Steel Processes.....	2361
<i>Bruno Touzo, Laurence Canton, Emmanuelle Henry-lannier</i>	

Novel Environmental Refractory Lining for Hot Metal Ladle: Carbon-Free Al ₂ O ₃ -SiC Brick.....	2364
<i>José Alvaro Sardelli, Carlos Pagliosa, Tiago Moreira, Julia Macedo, Vanderlucio Madalena</i>	

New Technology for Blast Furnace & Converter Refractory Maintenance

An Overview of Blast Furnace Refractory Lining Management by Acousto Ultrasonic-Echo Method	2370
<i>Afshin Sadri, Wai Lai Ying, Maria Tibbo, Harris Cornett, Liam Kelly</i>	
Improving Higher Magnesia-Containing Doloma-Based Bricks to Reduce Greenhouse Gas Emissions	2382
<i>Robert O'Brien, Carlos Lares, Herman Moggee</i>	
Challenges for the Refractory Industry to Support the Foreseen Large-Scale Transition to DRI Shaft Kilns	2388
<i>Erick Estrada, Gerald Hebenstreit, Stefan Postrach, Daniela Gavagnin, Taco Janssen</i>	

MATERIAL HANDLING/TRANSPORTATION & LOGISTICS

Advanced Automation Solutions

Billet Traceability with Innovative Automatic Tag Application	2396
<i>Ion Rusu, Anna Zoppirolli</i>	
Dynamic Simulation of a Port Terminal Shipment Operation for Iron Ore Exportation	2401
<i>Edenilson Silva Filho, Gustavo Gilberti, Luiz Montenegro</i>	
Bundle Bars Tagging and Counting Robotic Cell for Traceability	2411
<i>Ion Rusu, Valentino Bazzoli, Anna Zoppirolli</i>	

Author Index