

ASIA STEEL 2021

jointed with
Automotive Steel
International Conference

December 5–9, 2021
HICO, Gyeongju, Korea
Hybrid Conference

Hosted by



Organized by



Co-Organized by



The Indian Institute of Metals



The Iron and Steel Institute of Japan

Sponsored by



Supported by





TABLE OF CONTENTS

Conference Information

- 02 Welcome Message
- 03 ASIA STEEL History
- 04 Committee

Technical Programs

- 06 Program at a Glance
- 08 Venue Layout
- 09 Conference Topic
- 10 Session Timetable
- 12 Presentation Guidelines
- 13 Plenary Speakers



Useful Information

- 14** Social Programs
- 15** Online & Offline Assistance
- 16** Let's Meet on ZOOM

Presentation Schedule

Oral Session

- 18** MONDAY, December 6
- 27** TUESDAY, December 7
- 42** WEDNESDAY, December 8

Poster Session

65 Author Index

Welcome Message

Dear Colleagues and Friends,

On behalf of the ASIA STEEL 2021 organizing committee, I would like to welcome all the participants to the first ever hybrid conference of the ASIA STEEL International Conference!

When we organized ASIA STEEL 2021, we expected to greet every participant face-to-face and hoped to offer a conventional in-person type conference. Nevertheless, the current COVID-19 situation does not allow our hope to be realized. As the safety and well-being of all our participants is our first priority, we are finally gathered here physically and virtually.

First of all, I'm pleased to meet you here and would like to thank all of our participants for your continued patience and support along the way. There have been great advancements in research, development and production of steel technologies in the 21st century. With the interest we have seen for ASIA STEEL 2021, I believe that future improvements and developments for the coming years in the international community of this field will be spearheaded by our participants.

We have arranged a wealth of technical programs that feature a wide selection of experts in modern as well as traditional research and we have tried to make the virtual platform of ASIA STEEL 2021 as user friendly as possible. We will keep the virtual platform open during the conference, so that you can join all the live sessions, view the e-Posters, and check the online activities at your leisure. You can interact with the speakers and colleagues as much as you would in-person through Q&A time for oral presentations and using the chat discussion function for poster presentations.

We hope that all of you will find ASIA STEEL 2021 enjoyable and rewarding.



“

Dear colleagues, in this pandemic situation, we can't come together, but our ideas and knowledge can

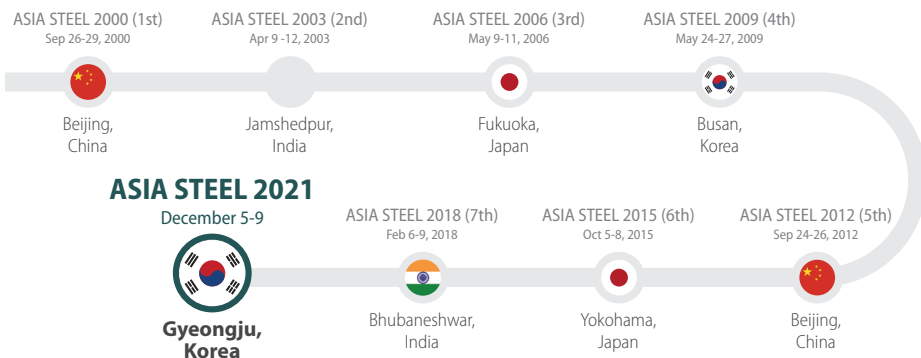
”

Chang Hee Yim

Chang Hee Yim

Chairman of ASIA STEEL 2021

ASIA STEEL HISTORY



TITLE	ASIA STEEL 2021 jointed with ASIC
DATE	December 5-9, 2021
VENUE	HICO, Gyeongju, Korea Online
HOSTED BY	The Korean Institute of Metals and Materials
ORGANIZED BY	Materials Education/Research Division for Creative Global Leaders, Seoul National University Education and Research Division for Futuristic Human-centric Materials, Yonsei University
CO-ORGANIZED BY	The Chinese Society for Metals The Indian Institute of Metals The Iron and Steel Institute of Japan
SUPPORTED BY	GyeongjuHwabaek Convention & Visitors Bureau
MEDIA PARTNER	Materials

HIGHLIGHT ON ASIA STEEL 2021!

The **1st Hybrid** conference

4 plenary, **63** keynote, **179** oral and **64** poster presentations from **17** countries

Awards for best posters

Virtual Platform that allows participants to share ideas and knowledge

Interesting **Social Programs**

Active Participation from **Korean Leading Companies**

Committee

Conference Chair

Chang Hee Yim
Pohang University of Science and Technology

Conference Vice Chair

Duk-Lak Lee
POSCO

Ju Tae Choi
Hyundai Steel

Secretary General

Youn-Bae Kang
Pohang University of Science and Technology

International Advisory Committee

Xinping Mao
CAE, University of Science and Technology Beijing, China

Hiroyuki Shibata
Tohoku University, Japan

Xinhua Wang
Shougang Group, China

Toshihiro Tanaka
MMS, Graduate School of Engineering, Osaka University, Japan

Pei Zhao
The Chinese Society for Metals, China

Toshihiro Tsuchiyama
Kyushu University, Japan

Amol A. Gokhale
Indian Institute of Technology Bombay, India

Se-don Choo
POSCO, Korea

Sanak Mishra
Indian Steel Association, India

Jeong-Whan Han
Inha University, Korea

T. V. Narendran
Tata Steel Limited, India

Sung-Joon Kim
Pohang University of Science and Technology, Korea

Tadashi Furuhashi
Institute of Materials Research, Tohoku University, Japan

Kisoo Kim
POSCO, Korea

Kazuhiro Seto
JFE Steel Corporation, Japan

Dong-Joon Min
Yonsei University, Korea

Local Organizing Committee

Moo-Eob Choi
POSCO

Youngjo Kang
Dong-A University

Yongsug Chung
Korea Polytechnic University

Young-Kook Lee
Yonsei University

Heung Nam Han
Seoul National University

Joo-Hyun Park
Hanyang University

Jae-il Jang
Hanyang University

Il Sohn
Yonsei University

Sung-Mo Jung
Pohang University of Science and Technology

Dong-Woo Suh
Pohang University of Science and Technology

Youn-Bae Kang
Pohang University of Science and Technology

Soon-Jae Tae
Hyundai Steel

Technical Committee

Chang-Hwan Chang

Research Institute of Industrial Science
and Technology

Moo-Eob Choi

POSCO

ShiHoon Choi

Suncheon National University

Yongsug Chung

Korea Polytechnic University

Yoo-Dong Chung

Hyundai Steel

Nam-Hun Goo

Hyundai Steel

Heung Nam Han

Seoul National University

DaeGeun Hong

Pohang University of Science and
Technology

Joo-Youl Huh

Korea University

Yoon-Uk Hur

Pohang University of Science and
Technology

Byoungchul Hwang

Seoul National University of Science
and Technology

Bo-Young Jeong

POSCO

Sung-Mo Jung

Pohang University of Science and
Technology

In-Ho Jung

Seoul National University

Youn-Bae Kang

Pohang University of Science and
Technology

Jong-Kwon Kim

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Jung-Gyu Kim

POSCO

Youngjo Kang

Dong-A University

Sun-Joong Kim

Chosun University

Hyokyung Sung

Gyeongsang National University

Namgyu Kim

SeAH Besteel

Wan-Yi Kim

POSCO

Yeongho Kim

POSCO

Young-Ha Kim

POSCO

Hyang-Jin Ko

Hyundai Steel

Joonho Lee

Korea University

Chang-Hoon Lee

Korea Institute of Materials Science

Myoung-Gyu Lee

Seoul National University

Young-Hoon Moon

Pusan National University

Joo-Hyun Park

Hanyang University

Yeong-Do Park

Dong-Eui University

Min-Hong Seo

POSCO

Jungho Shin

SeAH Special Steel

Il Sohn

Yonsei University

Gil-Ho Song

POSCO

Dong-Woo Suh

Pohang University of Science and
Technology

Soon-Jae Tae

Hyundai Steel

Jee-Hyun Kang

Yeongnam University

Jin-Kyung Kim

Hanyang University

Young Steel Scientist Award Committee

Program at a Glance

DECEMBER 5

DAY 1

SUNDAY

Welcome Reception

18:00-19:00 | Lounge (2F)



VIRTUAL PLATFORM ACCESS

ONLY registered participants can access the virtual platform with their login information.

To access, click “Virtual Website” on the main page of the website (www.asiasteel2021.org).

DECEMBER 6

DAY 2

MONDAY

Opening Ceremony

Plenary Session 1 & 2

09:00-10:30 | 300A (3F) & ZOOM

Refreshment Break

10:30-10:50

Plenary Session 3 & 4

10:50-12:10 | 300A (3F) & ZOOM

Lunch Break

12:10-13:20

Oral Session

13:20-15:40 | Session Rooms (2F) & ZOOM

Refreshment Break

15:40-16:00

Oral Session

16:00-18:00 | Session Rooms (2F) & ZOOM

Poster Session

24 hours | Online

DAY 3

DECEMBER 7

TUESDAY

Oral Session

09:00-10:20 | Session Rooms (2F) & ZOOM

Refreshment Break

10:20-10:40

Poster Session (Offline)

10:20-16:00 | Lobby (2F)

Oral Session

10:40-12:00 | Session Rooms (2F) & ZOOM

Lunch Break

12:00-13:20

Oral Session

13:20-15:40 | Session Rooms (2F) & ZOOM

Refreshment Break

15:40-16:00

Oral Session

16:00-18:00 | Session Rooms (2F) & ZOOM

Banquet & Award

18:30-20:00

Grand Ballroom (1F), Hilton Hotel

(*Participants need to move Hilton Hotel)

Poster Session

24 hours | Online

DAY 4

DECEMBER 8

WEDNESDAY

Oral Session

09:00-10:20 | Session Rooms (2F) & ZOOM

Refreshment Break

10:20-10:40

Oral Session

10:40-12:00 | Session Rooms (2F) & ZOOM

Lunch Break

12:00-13:20

Oral Session

13:20-15:40 | Session Rooms (2F) & ZOOM

Refreshment Break

15:40-16:00

Oral Session

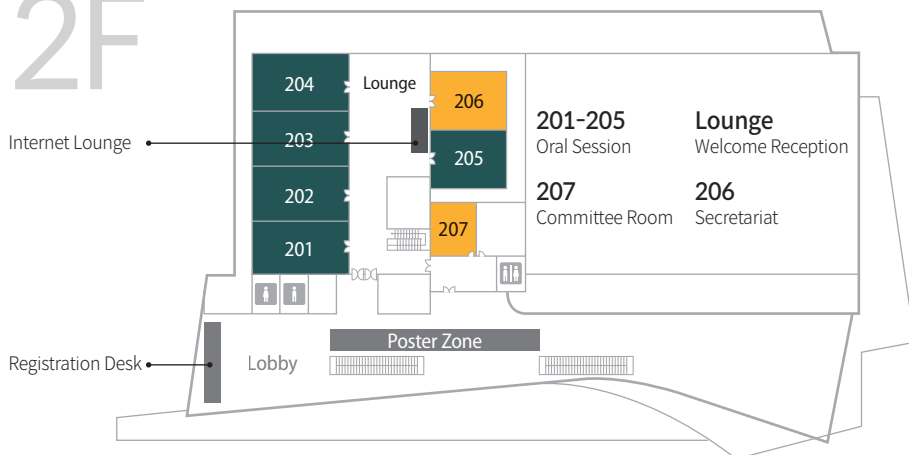
16:00-18:00 | Session Rooms (2F) & ZOOM

Poster Session

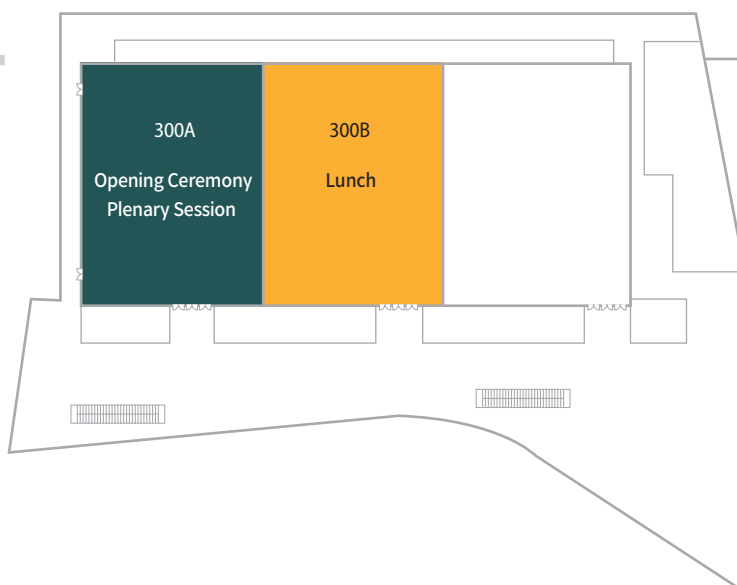
24 hours | Online

Venue Layout

2F



3F



Conference Topic

01. Raw Materials / Ironmaking / Direct Reduction

 Room 201

07. Analysis / Instrumentation

 Room 202

02. Environmental Engineering

 Room 202

08. Artificial Intelligence / Smart Factory

 Room 204

03-1. Steelmaking

 Room 202 (Nov. 7-8)

03-2. Casting

 Room 204 (Nov. 7)

 Room 201 (Nov. 8)

09. Sheet Forming (jointed with ASIC)

 Room 205

04. Rolling / Forging

 Room 204

10. Surface Engineering (jointed with ASIC)

 Room 204

05. Thermomechanical Treatment

 Room 203

11. Hydrogen Embrittlement (ASIC)

 Room 205

06. Joining / Welding

 Room 203

12. Advanced Automotive Steels (ASIC)

 Room 205

Session Timetable

December 5 (Sun)						
18:00-19:00	Welcome Reception Lounge (2F)					
December 6 (Mon)						
	Room 300A	Room 201	Room 202	Room 203	Room 204	Room 205
09:00-09:10	Opening Ceremony					
09:10-10:30	Plenary Session 1&2 Duck-Lak Lee Sanak Mishra					
10:30-10:50	Refreshment Break					
10:50-12:10	Plenary Session 3&4 Han Dong Kazuki Morita					
12:10-13:20	Lunch 300B (3F)					
13:20-15:40		01 Raw Materials / Ironmaking / Direct Reduction p. 18	07 Analysis / Instrumentation p. 19	05 Thermomechanical Treatment p. 21	04 Rolling / Forging p. 23	09 Sheet Forming (jointed with ASIC) p. 24
15:40-16:00	Refreshment Break					
16:00-18:00		01 Raw Materials / Ironmaking / Direct Reduction p. 19	07 Analysis / Instrumentation p. 20	05 Thermomechanical Treatment p. 22	04 Rolling / Forging p. 24	09 Sheet Forming (jointed with ASIC) p. 25
24 Hours	Poster Session (Online)					

December 7 (Tue)						
	2F Lobby	Room 201	Room 202	Room 203	Room 204	Room 205
09:00-10:20		01 Raw Materials / Ironmaking / Direct Reduction p. 27	02 Environmental Engineering p. 29	05 Thermomechanical Treatment p. 32	04 Rolling / Forging p. 35	12 Advanced Automotive Steels (ASIC) p. 38
10:20-10:40	Refreshment Break					
10:40-12:00	Poster Session (Only for Offline Presenter)	01 Raw Materials / Ironmaking / Direct Reduction p. 27	02 Environmental Engineering 03-1 Steelmaking p. 30	05 Thermomechanical Treatment p. 33	03-2 Casting p. 36	12 Advanced Automotive Steels (ASIC) p. 39
12:00-13:20		Lunch 300B (3F)				
13:20-15:40	Presentation Time: 12:40-13:20	01 Raw Materials / Ironmaking / Direct Reduction p. 28	03-1 Steelmaking p. 30	05 Thermomechanical Treatment p. 33	08 Artificial Intelligence / Smart Factory p. 36	11 Hydrogen Embrittlement (ASIC) p. 39
15:40-16:00	Refreshment Break					
16:00-18:00		01 Raw Materials / Ironmaking / Direct Reduction p. 29	03-1 Steelmaking p. 31	05 Thermomechanical Treatment p. 34	08 Artificial Intelligence / Smart Factory p. 37	11 Hydrogen Embrittlement (ASIC) p. 40
18:30-20:00	Banquet & Award 1F Grand Ballroom, Hilton Hotel					
24 Hours	Poster Session (Online)					

December 8 (Wed)					
	Room 201	Room 202	Room 203	Room 204	Room 205
09:00-10:20	03-2 Casting p. 42	03-1 Steelmaking p. 44	06 Joining / Welding p. 47		12 Advanced Automotive Steels (ASIC) p. 52
10:20-10:40	Refreshment Break				
10:40-12:00	03-2 Casting p. 42	03-1 Steelmaking p. 45	06 Joining / Welding p. 48	10 Surface Engineering (jointed with ASIC) p. 50	12 Advanced Automotive Steels (ASIC) p. 53
12:00-13:20	Lunch 300B (3F)				
13:20-15:40	03-2 Casting p. 43	03-1 Steelmaking p. 46	06 Joining / Welding p. 49	10 Surface Engineering (jointed with ASIC) p. 51	12 Advanced Automotive Steels (ASIC) p. 54
15:40-16:00	Refreshment Break				
16:00-18:00	03-2 Casting p. 44	03-1 Steelmaking p. 47	06 Joining / Welding p. 50	08 Artificial Intelligence / Smart Factory p. 52	12 Advanced Automotive Steels (ASIC) p. 54
24 Hours	Poster Session (Online)				

PRESENTATION GUIDELINES

Oral Session (Offline)	Poster Session (Offline)		
• 15 minutes for presentation + 5 minutes for Q&A • Given the Zoom livestreaming, please arrive in the session room at least 15 minutes before the session. • Submit your file to the staff of each presentation room before session starts. • The operator will load the presentation files to the laptop PC. • Present at the assigned time.	Date	Dec 6-8	Dec 7
	Location	Virtual Website (24 hours)	2F Lobby
	Put-up		09:00-10:00
	Presentation		12:40-13:20
	Take-down		17:00-18:00
	• Q&As will be made on-site and through the virtual website via comments and email.		

Plenary Speakers

POSCO's Technology Strategy toward Carbon-Free Steelmaking

09:10-09:50, Dec 6
300A 3F



Duck-Lak Lee

POSCO, Korea

The Status of Technology in the Integrated Steel Plants of India

09:50-10:30, Dec 6
300A 3F



Sanak Mishra

Indian National Academy of Engineering, India

The Scenario of High Performance Steels

10:50-11:30, Dec 6
300A 3F



Han Dong

Shanghai University, China

Recent Research Trend on Value Addition of Steelmaking Slags in Japan

11:30-12:10, Dec 6
300A 3F



Kazuki Morita

The University of Tokyo, Japan

Social Programs

WELCOME RECEPTION

On the first day of the conference, please join an ice-breaking event to getting to know each other! All participants who registered ASIA STEEL 2021 are invited to the welcome reception.

December 5 (Sun) 18:00–19:00
Lounge 2F

OPENING CEREMONY

It gives us a great pleasure to announce that ASIA STEEL 2021 Opening Ceremony is coming up on Monday. You all are cordially invited to the grand opening ceremony. We are looking forward for your gracious presence on this occasion.

December 6 (Mon) 09:00–09:10
300A 3F

BANQUET

Join us in the momentous occasion with a formal dinner for ASIA STEEL 2021. Please arrive by 6:30pm on December 7 at 1F Grand Ballroom, Hilton Hotel, and join us in the dinner reception.

December 7 (Tue) 18:30–20:00
Grand Ballroom 1F, Hilton Hotel



“YOUNG STEEL SCIENTIST AWARD”

This award is intended as acknowledgement and recognition for scientists who have contributed to the development of the field with their research and case studies.

The award will be presented at the ASIA STEEL 2021 Banquet and the recipient will be given a certificate of recognition and prize money worth KRW 100,000.

Online & Offline Assistance

“NEED HELP OFFLINE?”

You can ask help anytime. Your first contact point is the registration desk (2F) and will be very happy to assist delegates with enquiries. A wonderful team of ASIA STEEL 2021 staff will be available throughout the venue to assist with directions and assist at sessions.

“GET YOUR NAME BADGE

Participants are to wear their name badges at all times during the conference for identification and security purposes.

“DOWNLOAD DIGITAL RECEIPT & CERTIFICATE

- ✓ Click on the RECEIPT button on 'My Page' to print or download it.
- ✓ Click on the CERTIFICATE OF ATTENDANCE button on 'My Page' to print or download it.

“CONFERENCE SESSIONS

Sessions take place in the HICO's 2nd floor meeting rooms. Room assignments are found in the program book, pages 08.

Presenter can ask help at the session room.

ASIA STEEL 2021 staff will be ready to assist you anytime.



WIFI : ASIASTEEL2021



FREE PARKING

NO COST DURING THE CONFERENCE

“NEED HELP ONLINE?”

Q How do I access the Online Session?

A Only participants who have completed registration can access the ASIA STEEL 2021 Virtual Website with the registered login information.

Q Did you forget your ID/Password, or can't log in?

A You can e-mail (secretary@asiasteel2021.org) at secretariat of ASIA STEEL 2021 for your login information.

Q What are the technical requirements needed to participate in ASIA STEEL 2021 online?

A You need an Internet connection and web browser. The ASIA STEEL 2021 Virtual Website is not optimized for Internet Explorer. We recommend using Chrome, Edge, or Firefox.

“EMERGENCY CONTACT



+82-54-702-1196

secretary@asiasteel2021.org

asiasteel2021@gmail.com

Let's Meet on ZOOM

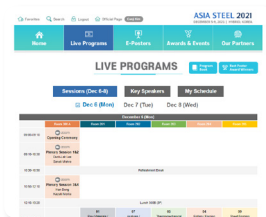
We are excited about our virtual platform and the experience it will provide. The new platform is sure to make the conference a remarkable experience.



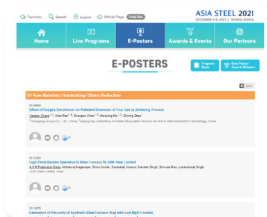
- Only participants who have completed registration can access the virtual website with same ID and PW of ASIA STEEL 2021 official website.
- Click "Join us Virtual Website" on the main page of the website (www.asiasteel2021.org) to access the virtual platform.



- The virtual website will help you have the best experience at ASIA STEEL 2021. Please use only Chrome, Edge or Firefox to access the platform.



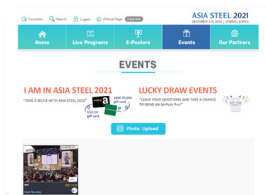
- Click on each session to check the list of the presentations and join the session in real-time through the Zoom linked to the timetable.



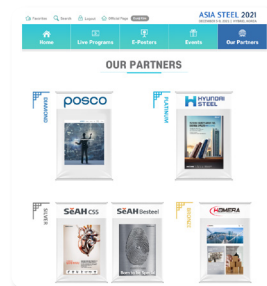
- View recent research from researchers and colleagues around the world to enrich your knowledge and share ideas in the field of steel.



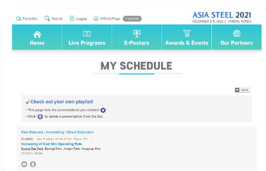
- With a single click, you can find any presentations you want to watch.



- Share your moment with ASIA STEEL 2021. Upload a picture while participating in the conference.



- Best way to extend your marketing reach worldwide! Find more information about our partners!



- Build your own playlist.



Presentation Schedule

01 Raw Materials / Ironmaking / Direct Reduction

MONDAY, December 06

Room 201

Chairs Sun-Joong Kim (Chosun University, Korea)
Liming Lu (Commonwealth Scientific and Industrial Research Organisation, Australia)

01-0714 Energy Conversion Challenges for the Steel Industry from Coal to Hydrogen

13:20-13:40 [Sang-Ho Yi](#)

KEYNOTE POSCO, Korea

01-1389 Strategies for Blast Furnace Operation in Higher PCI and Slag Rate

13:40-14:00 [A.V.R. Prabhakar Dasu](#), Naveen Singh, Shiva Kumar, Harikrishna Akula, Suresh Voonna,

ONLINE Rajagopal Gachchi, Rajesh Anand, Srinivas Rao, Lokendraraj Singh, Mohanraj Nagarajan
JSW Steel Ltd, India

01-0212 Gasification of Pulverized Coal in Low Oxygen Excess Ratio under Oxygen Blast Furnace Operating Conditions

14:00-14:20 [Yuya Morita](#), Koichi Takahashi, Sumito Ozawa, Yuki Kawashiri, Taihei Nouchi

ONLINE JFE Steel Corporation, Japan

01-1149 Modeling of Metallurgical Processes in a Blast Furnace Trough

14:20-14:40 [Subham Ranjan](#), Dipak Mazumdar

ONLINE Indian Institute of Technology Kanpur, India

01-0983 Effect of Ore Type, Basicity and Firing Temperature on Pellet Quality

14:40-15:00 [Byung Jun Chung](#)

POSCO, Korea

01-0997 Automatic Setting of Fuel Gas Flow Rate in Hot Stove Operation

15:00-15:20 [Gi Woong Kwon](#), Min Sik Na

POSCO, Korea

01-0259 Physical Properties of BF Slag for Ultra-High Proportion of V-Ti-Magnetite under Blast Furnace Smelting

15:20-15:40 [Zhengde Pang](#)¹, [Xuewei Lv](#)¹, Jiawei Ling¹, Yuyang Jiang¹, Zhiming Yan²

¹Chongqing University, China ²University of Warwick, UK

01 Raw Materials / Ironmaking / Direct Reduction

MONDAY, December 06

Room 201

Chairs Gaeon Kim (Hyundai Steel, Korea)
Xuewei Lv (Chongqing University, China)

01-0279 Simulation of Dust Recycling in the Dome Zone of a Melter-gasifier

16:00-16:20 Hyun-Soo Kim, Si-Kyung Yoon, Min-Young Cho

KEYNOTE POSCO, Korea

01-1347 Direct Production of Crude Stainless Steel Using Mine Waste by Thermal Plasma Process

16:20-16:40 Nikhil P.V.S., ANIL Chaubey, Priyanka Rajput, Bhagyadhar Bhoi

ONLINE CSIR-Institute of Minerals and Materials Technology Bhubaneswar, India

01-0635 Increasing of Coal Silo Operating Rate

16:40-17:00 Kyung Tae Park, Byungil Kim, Jongin Park, Hungsup Kim

POSCO, Korea

01-0492 Introduction and Investigation of a New Furnace for Lab-scale Iron Ore Pellet Induration Studies

17:00-17:20 Felix Firsbach¹, Guillaume Bruel¹, Liam Cotton¹, Michael Nispel¹, Pedro Bartolomeo²,

ONLINE Denise Alfenas Moreira², William Johnson³, Michel Lima⁴, Lucas Ferrara⁴, Georg Strüber⁵

¹Lhoist, Business Innovation Center, Belgium ²Lhoist Latin America, Brazil ³Lhoist, Business Innovation Center, USA ⁴ArcelorMittal Maizières Research Center, France ⁵Paul Wurth, Luxembourg

07 Analysis / Instrumentation

MONDAY, December 06

Room 202

Chairs Jae-il Jang (Hanyang University, Korea)
Jer-Ren Yang (National Taiwan University, Taiwan)

07-1378 Microstructural Characterization of Massive Ferrite in the Interstitial-Free Steel

13:20-13:40 Jer-Ren Yang

KEYNOTE National Taiwan University, Taiwan

ONLINE

07-0969 Promising Role of Nanoindentation in Structural Materials Research

13:40-14:00 Jae-il Jang

KEYNOTE Hanyang University, Korea

ORAL
DEC 6

07-0734 Role of Austenite Stability on the Yield Strength and Fracture Behavior in a Dual-phase Medium14:00-14:20 **Mn Steel****KEYNOTE** [T. T. T. Trang](#), [Yoon-Uk Heo](#)*Pohang University of Science and Technology, Korea***07-0806 Effects of C and Mo Additions on Grain Boundary Segregation of P in Ferrite**14:20-14:40 [Yongjie Zhang](#)¹, Kohei Ikeda², Koichiro Yamasaki¹, Goro Miyamoto¹, Tadashi Furuhashi¹**ONLINE** ¹*Tohoku University, Japan* ²*JSW Steel Ltd., Japan***07-0709 Influencing Factors on Resistance to Environmentally Assisted Cracking of Martensitic Steels**14:40-15:00 Sangeun Park¹, Im Doo Jung², Jung Gi Kim¹, Jae Bok Seol¹, [Hyokyung Sung](#)¹¹*Gyeongsang National University, Korea* ²*Ulsan National Institute of Science and Technology, Korea***07-1071 3D Non-destructive Characterization of Electrical Steels for Quantitative Texture Analysis with**15:00-15:20 **Lab-based X-ray Diffraction Contrast Tomography****ONLINE** [Yanjiing Yang](#)¹, Jun Sun², Shaun David Graham¹, Florian Bachmann², Erik Lauridsen²¹*ZEISS Group, Singapore* ²*Xnovo Technology ApS, Denmark***07-0890 Determination of Lead, Tin, Arsenic, Antimony and Bismuth in Ferromolybdenum by Inductively**15:20-15:40 **Coupled Plasma-mass Spectrometry****ONLINE** [Zhang Jie](#)*Anshan Iron and Steel Group Co., Ltd., China***07 Analysis / Instrumentation****MONDAY, December 06****Room 202**Chairs [Yoon-Uk Heo](#) (Pohang University of Science and Technology, Korea)[Takahito Ohmura](#) (National Institute for Materials Science, Japan)**07-0351 Nano-mechanical Characterization in High Strength Steels for Interpretation of Macroscopic**16:00-16:20 **Properties****KEYNOTE** [Takahito Ohmura](#)**ONLINE** *National Institute for Materials Science, Japan***07-0320 Correlative Light, Electron and In Situ Raman Imaging of Modern and Historic Railway Tracks,**16:20-16:40 **Linking Wear and Corrosion to Microstructure and Composition**[Andy Holwell](#)¹, Roger Barnett¹, Ute Schmidt²¹*Carl Zeiss Microscopy Ltd, UK* ²*WITec Wissenschaftliche Instrumente und Technologie GmbH, Germany*

07-0654 Study of Smart Analytical Techniques for Steel Production with Artificial Intelligence

16:40-17:00 Taechang Park, Sungho Lee, Wonhyo You, Yongki Seo
Hyundai Steel, Korea

07-0637 Interpreting X-ray Diffraction Contrast for Non-destructive 3d Grain Mapping of Metals in Laboratory CT

Andy Holwell¹, Hrishikesh Bale², Jun Sun³, Jette Oddershede³
¹Carl Zeiss Microscopy Ltd, UK ²Carl Zeiss X-ray Microscopy, Inc., USA ³Xnovo Technology ApS, Denmark

05 Thermomechanical Treatment**MONDAY, December 06****Room 203**

Chairs Zengbao Jiao (The Hong Kong Polytechnic University, Hong Kong)
Byoungchul Hwang (Seoul National University of Science and Technology, Korea)

05-0562 Electric Current Induced Enhancement of Recrystallization Kinetics in Steel

13:20-13:40 Kyeongjae Jeong¹, Sung-Woo Jin¹, Sung-Tae Hong², Moon-Jo Kim³, Heung Nam Han¹

KEYNOTE ¹Seoul National University, Korea ²University of Ulsan, Korea ³Korea Institute of Industrial Technology, Korea

05-0155 Role of Grain Size and Grain Boundary Microstructure in Controlling Sensitization and Intergranular Corrosion of AISI Type 304 L Stainless Steel

13:40-14:00 ^(P) **ONLINE** Gopinath Shit¹, Sudhanshu Shekhar Singh², Mariappan K¹, S Ningshen¹

¹Indira Gandhi Centre for Atomic Research, India ²Indian Institute of Technology Kanpur, India

05-0371 Integrated Mechanical-microstructure Modeling: Anisotropy and Formability Prediction for Annealed Steel Sheet

14:00-14:20 Kyung Mun Min¹, Hyuk Jong Bong², Seung Hyun Hong³, Heung Nam Han¹, Myoung-Gyu Lee¹

¹Seoul National University, Korea ²Korea Institute of Materials Science, Korea ³Hyundai Motor Group, Korea

05-0836 Effects of Microstructures on Mechanical Properties of the High Strength Steels Containing Low Temperature Transformation Ferrite

14:20-14:40 Youngwoo Kim, Hyunbo Shim, Seunggho Hong, Sanghyup Lee, Kyutae Kim
Hyundai Steel, Korea

05-0219 Effects of Pre-Deformation Process on Bainite Transformation

14:40-15:00 Shixin Xu¹, Wei Yu², Naibing Lv¹, Zhijun Luo¹, Kun Wang¹, Qisong Sun¹

^(P) **ONLINE** ¹Shougang Group Co., Ltd., China ²University of Science and Technology Beijing, China

05-0659 The Practice of Atmosphere Control for Reheating Furnace in Hot Strip Mill

15:00-15:20 Tianfu Zhang, Guangyu Ma, Weidong Li, Yu Zhao, Wei Xu
^(P) **ONLINE** Ansteel Group, China

05-1291 A Study on the Thermal Creep Properties of HT9 Cladding for Sodium-Cooled Fast Reactor15:20-15:40 [Dongha Kim](#), Young-Kook Lee*Yonsei University, Korea***05 Thermomechanical Treatment****MONDAY, December 06****Room 203**Chairs Heung Nam Han (Seoul National University, Korea)
Takuya Maeda (Kyushu University, Japan)**05-0920 Control of Continuous and Discontinuous Precipitation in NiAl-strengthened High-strength Steels**16:00-16:20 Bingchen Zhou, [Zengbao Jiao](#)**KEYNOTE** *The Hong Kong Polytechnic University, Hong Kong* **ONLINE****05-1010 Effect of B on the Superplasticity of Fe-6.6Mn-2.0Al Alloy**16:20-16:40 [Hyun-Bin Jeong](#)¹, Seok-Hyeon Kang¹, Jin-Sung Hong¹, Young-Kook Lee^{1,2}¹*Yonsei University, Korea* ²*Pohang University of Science and Technology, Korea***05-0979 The Characteristics of Athermal Martensitic Transformation after Annealing and Cooling of the 304 Austenitic Stainless Steel Sheets**

16:40-17:00

[Fazlollah Sadeghi](#)¹, Tahereh Zargar¹, Jong Wan Kim², Yoon-Uk Heo¹, Jae Sang Lee¹, Chang Hee Yim¹¹*Pohang University of Science and Technology, Korea* ²*POSCO, Korea***05-0922 Multiscale Modeling for Predicting Dynamic Recrystallization Behavior of Stainless Steel under Thermo-mechanical Process**

17:00-17:20

[Jinheung Park](#)¹, Myoung-gyu Lee¹, Kyung Mun Min¹, Matruprasad Rout²¹*Seoul National University, Korea* ²*National Institute of Technology Tiruchirappalli, India***05-0840 Verification of Thermodynamic Models for the Prediction of Grain Boundary Segregation of Carbon and Nitrogen in Ferrite Steel**

17:20-17:40

 **ONLINE** [Yuxiong Zhou](#), Takuro Masumura, Toshihiro Tsuchiyama*Kyushu University, Japan*

04 Rolling / Forging

MONDAY, December 06

Room 204

Chairs ShiHoon Choi (Sunchon National University, Korea)
Chang Wang (Shougang Research Institute of Technology, China)

04-0858 Microstructure and Mechanical Property Control during Metal Forming Considering the Whole Processes

13:20-13:40

KEYNOTE

Shi-Hong Zhang, Shuai-Feng Chen, Hong-Wu Song, Ming Cheng

ONLINE *Institute of Metal Research, Chinese Academy of Sciences, China*

04-1027 Effect of Si-Cr-Mo Element of Cold Rolled Dual-Phase Steel on Oxidation Characteristics and Surface Quality

13:40-14:00

ONLINE Chang Wang, Yang Yu

Shougang Research Institute of Technology, China

04-1306 Development of Numerical Model Based Deep Learning for the Roll Force Prediction in the Sendzimir Mill

14:00-14:20

Yong Seok Cho, Jea Sook Chung

POSCO, Korea

04-0848 Recovery of Ductility by Cold Rolling of ECAPed Low Carbon Steel

14:20-14:40

Debabrata Bhuyan, Raj Bahadur Singh, G.V.S Sastry, Rampada Manna

ONLINE *Indian Institute of Technology, Banaras Hindu University, Varanasi, India*

04-0663 Influence of Si and P Ratio on Oxidation Characteristics of Steel

14:40-15:00

Wang Lin

ONLINE *Shougang Group Co., Ltd., China*

04-1368 Analysis and Control of Bar Warping in Roughing Mill of HSM

15:00-15:20

Hyuckcheol Kwon¹, Jongwhan Lee², Seungchul Lee², Taekyu An¹, Youngseok Cho¹, Jeasook Chung¹

¹POSCO, Korea ² Pohang University of Science and Technology, Korea

04 Rolling / Forging

MONDAY, December 06

Room 204

Chairs Qi Zhang (Xi'an Jiaotong University, China)
Hyuckcheol Kwon (POSCO, Korea)

04-1273 Precision Forming Process by Rotary Swaging

16:00-16:20 Qi Zhang, Tiantai Tian, Miao Cao

KEYNOTE Xi'an Jiaotong University, China

 ONLINE

04-1049 Study on Texture Evolution in Cold Rolled High Entropy Alloy during Annealing

16:20-16:40 Lalit Kaushik¹, Jaiveer Singh², Joo-Hee Kang³, Dong-Ik Kim⁴, Jin-Yoo Suh⁴, Shi-Hoon Choi¹

¹Sunchon National University, Korea ²Indian Institute of Technology, India ³Korea Institute of Materials Science, Korea ⁴Korea Institute of Science and Technology, Korea

04-0683 Prediction of Austenite Grain Size Evolution in Wire Rod Rolling

16:40-17:00 Mohammed Rasul Iqbal, Soorya Prakash Jayaraj, Manjini Sambandam

 ONLINE JSW Steel Ltd., Salem Works, India

09 Sheet Forming (jointed with ASIC)

MONDAY, December 06

Room 205

Chairs Hwigeon Kim (POSCO, Korea)
Baptiste Reyne (Pohang University of Science and Technology, Korea)

09-0380 Anisotropic Ductile Fracture of 304L Stainless Steel

13:20-13:40 Madhav Baral¹, Yannis Korkolis²

KEYNOTE ¹University of Kentucky, USA ²The Ohio State University, USA

 ONLINE

09-0911 Predictive Anisotropic Hardening Model for Strength Evaluation after Multiple Bending of API Steel

13:40-14:00 Hongjin Choi¹, Seonghwan Choi¹, Chanmi Moon¹, Soo-Chang Kang², Myoung-Gyu Lee¹

KEYNOTE ¹Seoul National University, Korea ²POSCO, Korea

09-0456 Forming of Advanced High Strength Steels by Chain-die Forming

14:00-14:20 Dayong Li

KEYNOTE Shanghai Jiao Tong University, China

 ONLINE

- 09-1375** Coupled Crystal Plasticity and Marciniak-Kuczynski Approach Incorporated with Surface Roughening Effect to Predict Forming Limit Diagram of Thin Ferritic Stainless Steel

Hyuk Jong Bong, Jinwoo Lee

Korea Institute of Materials Science, Korea

- 09-1048** Effect of Microstructural Factors on Surface Roughness Development of IF Steel during Uniaxial Tension

Ki Seong Park, Lalit Kaushik, Shi-Hoon Choi

Sunchon National University, Korea

- 09-1007** An Experimental and Analytical Approach to Stretch-bending Failure of AHSS

15:00-15:20 Jaewook Lee

POSCO, Korea

09 Sheet Forming (jointed with ASIC)

MONDAY, December 06

Room 205

Chairs Hyuk Jong Bong (Korea Institute of Materials Science, Korea)
Dayong Li (Shanghai Jiao Tong University, China)

- 09-0348** Advanced Material Modeling Approach and Application to AHSS Forming Process Simulations

16:00-16:20 Frederic Barlat, Seong-Yong Yoon, Shin-Yeong Lee, Min-Su Wi, Jin-Hwan Kim

KEYNOTE *Pohang University of Science and Technology, Korea*

- 09-0375** Is the Material Model Identified Using Linear Stress Paths Still Valid for Nonlinear Stress Paths?

16:20-16:40 Toshihiko Kuwabara

KEYNOTE *Tokyo University of Agriculture and Technology, Japan*

📺 ONLINE

- 09-0999** HEXAH, a New Constitutive Framework for Modeling Advanced High Strength Steels

16:40-17:00 Baptiste Reyne, Frédéric Barlat

Pohang University of Science and Technology, Korea

- 09-0843** Stretch-flangeability of CoCrFeMnNi High-entropy Alloy, Stainless Steel, and TWIP Steel

17:00-17:20 Yeon Taek Choi¹, Jae Wung Bae², Jeong Min Park¹, Hak Hyeon Lee¹, Hyeonseok Kwon¹, Sujung Son¹,
Hyoung Seop Kim¹

¹Pohang University of Science and Technology, Korea ²Max Planck Institute for Iron Research, Germany

- 09-0475** A Method for Selecting Optimal Materials in Sheet Metal Forming Process

17:20-17:40 Hwigeon Kim, Jongwon Choi

POSCO, Korea

09-0228 Prediction of Hole Expansion Ratio and Microstructural Evolution Using Microstructure-Based Dual-Scale Calculation

17:40-18:00

Jinwook Jung¹, Siwook Park¹, Woojin Cho¹, Byeong-Seok Jeong¹, Hyuntaek Na², Sung-Il Kim²,
Myoung-Gyu Lee¹, Heung Nam Han¹

¹Seoul National University, Korea ²POSCO, Korea

01 Raw Materials / Ironmaking / Direct Reduction

TUESDAY, December 07

Room 201

Chair Jiook Park (POSCO, Korea)

01-0307 Characteristics and Mitigation Technologies of Iron Ore Sintering Emissions – A review09:00–09:20 [Liming Lu](#)

KEYNOTE

Commonwealth Scientific and Industrial Research Organisation, Australia

ONLINE

01-0740 Development and Application of Anti-Nodulation Technology of Sintering Igniter09:20–09:40 [Wen Pan](#)^{1,2}, [Suochao Qiu](#)³, [Yuanyuan Cui](#)^{1,2}, [Yapeng Zhang](#)¹, [Shaoguo Chen](#)^{1,2}ONLINE ¹Research Institute of Technology of Shougang Group Co., Ltd., China ²Beijing key Laboratory of Green Recyclable Process for Iron & Steel Production Technology, China ³Shougang Jingtang United Iron & Steel Co., Ltd., China**01-0438** Utilisation of Carbon Rich Waste Material in Pelletisation of Indian Hematite Ore09:40–10:00 [Ammasi Ayyandurai](#), [Jagannath Pal](#)ONLINE *CSIR-National Metallurgical Laboratory, India***01-1216** Experimental Study on the Particle Segregation in Sinter Shaft Cooling Furnace10:00–10:20 [Xiangbo Xu](#)¹, [Lijun Wu](#)¹, [Chuanguang Bi](#)²ONLINE ¹Tongji University, China ²Baoshan Iron and Steel Co., Ltd., China

01 Raw Materials / Ironmaking / Direct Reduction

TUESDAY, December 07

Room 201

Chair Dong-Min Jang (POSCO, Korea)

01-0443 Effect of MgO on Phase Development in Hematite-ilmenite Ore Sinter10:40–11:00 [Edson Kugara Chiwandika](#), [Jinbi Bok](#), [Sungmo Jung](#)

KEYNOTE

*Pohang University of Science and Technology, Korea***01-0428** Numerical Study of MIDREX Shaft11:00–11:20 [Sunil Yadav](#)¹, [Prasenjit Singha](#)¹, [Srishilan C](#)², [Ajay Kumar Shukla](#)¹ONLINE ¹Indian Institute of Technology, Madras, India ²Indian Institute of Technology, Jammu, India

01-0244 Effect of Highly Reactive Biomass Burden on the Chemical Reaction in Blast Furnace Shaft

11:20-11:40 [Gaeon Kim](#), Youngjoo Park, Jonghyup Lee, Teajun Park, Yubin Lee, Hansang Oh, Junyong Kim,
Dongsoo Lee, Byongchul Kim
Hyundai Steel, Korea

01-1087 Development of Numerical Model for Sintering Process

11:40-12:00 [Sun-Joong Kim](#)¹, Geun-Yong Ryu¹, Ki-Woo Lee², Ju-Hee Choi²
¹*Chosun University, Korea* ²*Hyundai Steel, Korea*

01 Raw Materials / Ironmaking / Direct Reduction

TUESDAY, December 07

Room 201

Chairs Joonho Lee (Korea University, Korea)
Hiroshi Nogami (Tohoku University, Japan)

01-0289 Thermal Fluid Analysis of Cohesive Zone of Blast Furnace

13:20-13:40 [Hiroshi Nogami](#), Shungo Natsui, Azuma Hirai, Jeongin Kim

KEYNOTE *Tohoku University, Japan*

 **ONLINE**

01-0655 The Application of Oxygen Enrichment Combustion on Hot Blast Stove

13:40-14:00 [Tianfu Zhang](#), Shoubin Sun, Fanshuang Meng, Aihua Zhao

 **ONLINE** *Ansteel Group, China*

01-0304 Experience of Implementing Highly-Efficient Technology of Kalugin Top Combustion Stove in Russia

14:00-14:20  **ONLINE** Sergey Ivlev, Anton Subbotin, Boris Prokofiev, Yury Murzin, [Maxim Aksyushin](#)

Joint-Stock Company KALUGIN, Russia

01-0768 Rheological Approach of Coal Evaluation for FINEX Coal Briquettes

14:20-14:40 [Jae Dong Kim](#)

POSCO, Korea

01-1197 Exploratory Studies on Beneficiation of Low-grade Banded Iron Ore Formations (BIF) of Karnataka, India

14:40-15:00  **ONLINE** [Ajita Kumari](#), Vasumathi Nallusamy, Abhishek Palli, TV. Vijaya Kumar

CSIR National Metallurgical Laboratory, India

01-0744 Effect of Adding Calcium Ferrites to the Sinter Mix on the Sintering Temperature

15:00-15:20 [Leonardo Tomas da Rocha](#)¹, Seongkyu Cho¹, Sung-Wan Kim², Sung-Mo Jung¹

¹*Pohang University of Science and Technology, Korea* ²*POSCO, Korea*

01-0193 Investigation of Nitrogen Status in Coal Affecting the Production of NO in Its Combustion

15:20-15:40 [Seongkyu Cho](#)¹, Leonardo Tomas da Rocha¹, Byung-Jun Chung², Sung-Mo Jung¹

¹Pohang University of Science and Technology, Korea ²POSCO, Korea

01 Raw Materials / Ironmaking / Direct Reduction

TUESDAY, December 07

Room 201

Chair Moo Eob Choi (POSCO, Korea)

01-0873 Intelligent Automation Development of Prediction Model of Slag Viscosity

16:00-16:20 [Joonho Lee](#), Hyeonwoo Park, Haeung Lee, Jiwoo Park, Jinhyun Chun

KEYNOTE *Korea University, Korea*

01-1182 Effects of Basicity and Alumina Concentration on Silico-Ferrite of Calcium and Aluminum (SFCA) Crystal Structure

16:20-16:40

[Junwoo Park](#), Hyeonwoo Park, Joonbeom Park, In-Kook Suh, Joonho Lee

Korea University, Korea

01-0885 Advanced Hearth Liquid Level and Flowability Monitoring by Strain Gauge

16:40-17:00 [Jiook Park](#), Mooeob Choi, Sangbin Kim

POSCO, Korea

01-1091 Influence of Slag Basicity and Solid Fuel Mixture on Formation of Liquid Phase in Sintered Ore and Sintering Temperature

17:00-17:20

[Geun Yong Ryu](#)¹, Sun Joong Kim¹, Ki Woo Lee², Ju Hee Choi²

¹Chosun University, Korea ²Hyundai Steel, Korea

02 Environmental Engineering

TUESDAY, December 07

Room 202

Chair Sung-Mo Jung (Pohang University of Science and Technology, Korea)

02-1068 Utilization of Steel Slag for Resource Circulation in Korea

09:00-09:20 [Sanghyung Lee](#), Dong-Jun Shin, Kwangseo Cha, Sung-In Hong, Je-Shin Lee

KEYNOTE *Hyundai Steel, Korea*

02-0187 Alkali-Activated Steel-Making Slags for the Application of Wastewater Treatment

09:20-09:40 [Zuotai Zhang](#)¹, Ningning Shao²

KEYNOTE ¹Southern University of Science and Technology, China ²Shenzhen Institute of Information Technology, China

(P) ONLINE

ORAL
DEC 7

02-0617 Feasibility Assessment of Ferrous By-Products in FINEX

09:40-10:00 [Moo Eob Choi](#)

KEYNOTE *POSCO, Korea*

02-0265 Effect of MnO Additions to Synthesized Stainless Steel Slags to Stabilize Chromium

10:00-10:20 [Zhanjun Wang](#), [Il Sohn](#)

KEYNOTE *Yonsei University, Korea*

02 Environmental Engineering 03-1 Steelmaking

TUESDAY, December 07

Room 202

Chair [Il Sohn](#) (Yonsei University, Korea)

02-0237 Insights into Conversion of Slag Thermal Energy to Chemical Energy

10:40-11:00 [Min Seok Seo](#), [Il Sohn](#)

Yonsei University, Korea

Chairs [Youngjo Kang](#) (Dong-A University, Korea)
[Siddhartha Misra](#) (Tata Steel BSL, India)

03-0165 Progress of Hot Metal Pretreatment Process

11:00-11:20 [Naoki Kikuchi](#), [Yoshie Nakai](#), [Akitoshi Matsui](#), [Yasuo Kishimoto](#)

KEYNOTE *JFE Steel Corporation, Japan*

 **ONLINE**

03-0199 Impact of Hot Metal Si/P Ratio on Vessel Dephosphorization

11:20-11:40 [Pramod Kumar Tripathy](#), [Saroj Kumar Singh](#)

 **ONLINE** *Tata Steel Ltd., India*

03-1 Steelmaking

TUESDAY, December 07

Room 202

Chairs [Youn-Bae Kang](#) (Pohang University of Science and Technology, Korea)
[Lifeng Zhang](#) (Yanshan University, China)

03-0241 Conarc Steelmaking at Tata Steel BSL: An Improvement Journey

13:20-13:40 [Siddhartha Misra](#), [Vimal Tiwari](#), [Adiraju Kranthi Kumar](#), [Harpanahalli Maheshbabu](#), [Subodh Pandey](#)

KEYNOTE *Tata Steel BSL Ltd., India*

 **ONLINE**

03-0437 Double Slag Practice in Induction Furnace Steelmaking13:40-14:00 [Ammasi Ayyandurai](#)ONLINE *National Metallurgical Laboratory, India***03-0528 A Numerical Study of Refractory Flow-Induced Erosion and Reaction-Induced Corrosion in Ladle Refining Process**14:00-14:20 [Qiang Wang¹](#), Zhu He¹, Yunming Gao¹, Guangqiang Li¹, Yawei Li¹, Qiang Wang²¹Wuhan University of Science and Technology, China ²Northeastern University, China**03-0505 Effect of Converter Shape on Reaction Rate between Slag and Metal in a Combined Blowing Converter with Inert Gas Bottom Blowing**14:20-14:40 [Hironori Yoshida¹](#), Shota Amano¹, Yoshie Nakai¹, Yukio Takahashi², Naoki Kikuchi¹¹JFE Steel Corporation, Japan ²JFE Techno-Research Corporation, Japan**03-1034 Mechanism of Metallurgical Quality Improvement of Ingot Processed by Vacuum Electroslag Remelting**14:40-15:00 [Yu Liu¹](#), Guangqiang Li¹, Qiang Wang¹, Baokuan Li²¹Wuhan University of Science and Technology, China ²Northeastern University, China**03-0343 A Case Study on – Effect of Ladle Bottom Stability over Ladle Slide Gate Failures**15:00-15:20 [Sahin Ali¹](#), Hiroshi Nagata², Gautam Choudhury¹, Kido Naofumi², Gaurav Pandey¹,ONLINE Chava Venkata Appaiah Chowdary¹, Arnab Acharya¹, Manish Kumar¹¹TRL Krosaki Refractories Limited, India ²TRL Krosaki Refractories Limited, Japan**03-1 Steelmaking****TUESDAY, December 07****Room 202**

Chair Joohyun Park (Hanyang University, Korea)

03-0180 Development of Utilization Technology of Desulfurization Slag-Iron in Converter16:00-16:20 [Pan Gao](#)ONLINE *Shougang Group Co., Ltd., China***03-0677 Improve Reaction Capacity by Utilizing Aluminum Slag**16:20-16:40 [Rensheng Chu](#)ONLINE *Shougang Group Co., Ltd., China***03-0296 Optimization of Refractory Erosion in Energy Optimizing Furnace(EOF)**16:40-17:00 [Krishnakumar K](#), Vimal M, Elango K PONLINE *JSW Steel Ltd., India*

03-1192 Life Enhancement of Basic Oxygen Furnace Refractory Lining through Selective Slag Splashing
 17:00-17:20 **Process: Physical Modelling & Plant Trials**
 ONLINE [Ravi Golani](#), Ashutosh Kumar, V S Shekhawat, Tapas Kumar Roy
Tata Steel Ltd., India

03-0333 Modification in Ladle Slide Gate System to Ensure Safe Tapping Operation
 17:20-17:40 Sahin Ali, Gautam Kr Choudhury, Suchit Mahanta, [Gaurav Pandey](#), Manishankar Mukherjee,
 ONLINE Ujjwal Kumar, Deepak Kumar, Manish Kumar
TRL Krosaki Refractories Limited, India

05 Thermomechanical Treatment

TUESDAY, December 07

Room 203

Chair Jae Bok Seol (Gyeongsang National University, Korea)

05-0346 Novel Alloy Design and Heat Treatments to Enhance Fatigue Performance after Surface
 09:00-09:20 **Hardening Heat Treatments**
KEYNOTE [Kip Findley](#)¹, Jonah Klemm-Toole¹, Milan Agnani¹, Larissa Vilela¹, Steven Thompson¹, John Speer¹,
 ONLINE Vincent Lelong², Dennis Beauchesne²
¹Colorado School of Mines, USA ²ECM USA, Inc., USA

05-0826 Microstructure Property Relationship in Low Carbon Martensitic Steel by Direct Quenching and
 09:20-09:40 **Tempering Process**
[Yong Min Hyun](#)
Hyundai Steel, Korea

05-0481 Changes in Solute Carbon Concentration and Mechanical Properties during Low-temperature
 09:40-10:00 **Tempering in Martensitic Carbon Steel Containing Retained Austenite**
 ONLINE [Shohei Uranaka](#)¹, Takuro Masumura¹, Toshihiro Tsuchiyama¹, Takuya Maeda¹, Yuuzoh Kawamoto²,
 Hiroyuki Shirahata², Ryuji Uemori¹
¹Kyushu University, Japan ²Nippon Steel Corporation, Japan

05-0778 The Effect of the Incomplete Dynamic Recrystallization on the High-Temperature Mechanical
 10:00-10:20 **Property in a Fe-Mn-Al-C Steel**
 ONLINE [Shuai Zhao](#)¹, Renbo Song¹, Yongjin Wang¹, Jun Yanagimoto², Tom Taylor², Bin Hu¹
¹University of Science and Technology Beijing, China ²The University of Tokyo, Japan

05 Thermomechanical Treatment

TUESDAY, December 07

Room 203

Chair Young-Roc Im (POSCO, Korea)

05-0783 Development of High-Strength Seismic Resistant Reinforced Steel Bars by Multi-Scale Simulation and Machine Learning

10:40-11:00

KEYNOTE

Byoungchul Hwang¹, Myoung-Gyu Lee², Jae-Hyeok Shim³, Joonho Lee⁴

¹Seoul National University of Science and Technology, Korea ²Seoul National University, Korea

³Korea Institute of Science and Technology, Korea ⁴Korea University, Korea

05-0719 Bainitic Transformation Strengthening of H-Sectioned Steels and Its Effects on the Seismic/Fire-Resistant Characteristics

11:00-11:20

Tae Yeong Kim¹, Joon Oh Moon², Chang Hoon Lee², Jun Ho Chung³, Young Su Lee⁴, Hyun Uk Hong¹

¹Changwon National University, Korea ²Korea Institute of Materials Science, Korea

³Hyundai Steel, Korea ⁴Korea Institute of Science and Technology, Korea

05-0710 Static Strain Aging Behavior in 16Cr-5Ni Metastable Austenitic Stainless Steel

11:20-11:40

Hojun Gwon¹, Sung-Ho Kim¹, Jong Jin Jeon², Sung-Joon Kim¹

¹Pohang University of Science and Technology, Korea ²POSCO, Korea

05-0698 Tensile and Fracture Toughness Behaviour of Thermomechanically Rolled Direct Quenched & Partitioned (TMR-DQP) Steels

11:40-12:00

ONLINE

Gaurav Kumar¹, Jeet Patil¹, Sakari Pallaspuro², Sumit Ghosh², Mahesh Somani², Sushil K. Mishra¹,

Amol A. Gokhale¹

¹Indian Institute of Technology Bombay, India ²University of Oulu, Finland

05 Thermomechanical Treatment

TUESDAY, December 07

Room 203

Chairs Heung Nam Han (Seoul National University, Korea)
Toshihiro Tsuchiyama (Kyushu University, Japan)

05-0849 Enhancement of Fire Resistance in Steels with Mo and Nb

13:20-13:40

KEYNOTE

Chang-Hoon Lee¹, Sung-Dae Kim¹, Hyo-Haeng Jo¹, Joonoh Moon¹, Jae Hoon Jang¹, Chansun Shin²,

Bong Ho Lee³, Jun-Ho Chung⁴, J. G. Speer⁵, K. O. Findley⁵

¹Korea Institute of Materials Science, Korea ²Myoungji University, Korea ³Daegu Gyeongbuk Institute of Science and Technology, Korea ⁴Hyundai Steel Company, Korea ⁵Colorado School of Mines, USA

ORAL
DEC 7

05-0694 An Approaching Using Optimization Algorithms for Development of Sigma Phase-free Stainless Steel

13:40-14:00

Young Jin Kwon, Gyu Jin Jo
POSCO, Korea

05-0609 High Temperature Compression Behavior of Interstitial Alloyed 15CR-15MN-4NI Austenitic Stainless Steels

14:00-14:20

Yeongeun Cho, Hojun Gwon, Sung-Joon Kim
Pohang University of Science and Technology, Korea

05-0603 Effects of Bakign Treatment on Uniaxial Tensile Behavior in Low Carbon Steel Accompanying Yield Point Phenomenon

14:20-14:40

Woojin Cho¹, Byeong-Seok Jeong¹, Siwook Park¹, Jinwook Jung¹, Hyuntaek Na², Sung-Il Kim², Dong-Woo Suh³, Heung Nam Han¹
¹Seoul National University, Korea ²POSCO, Korea ³Graduate Institute of Ferrous Technology, Korea

05-0496 Control of Martensite-austenite Constituents by Accelerated Cooling

14:40-15:00

Sangho Kim, Jaeyoung Cho, Jang-Yong Yoo
POSCO, Korea

05-0484 Size-dependent Dislocation Strengthening in 1.2 GPa Low-Mn Lightweight Steel

15:00-15:20

Hyo Ju Bae¹, Kwang Kyu Ko¹, Jae Seok Jeong², Jung Gi Kim¹, Hyokyung Sung¹, Jae Bok Seol¹
¹Gyeongsang National University, Korea ²Doosan Heavy Industries & Construction, Korea

05 Thermomechanical Treatment

TUESDAY, December 07

Room 203

Chair Young Jin Kwon (POSCO, Korea)

05-0477 Microstructure Characterization of Deformation Behavior in Medium Mn Steels

16:00-16:20

Takuya Maeda^{1,2}, Shinya Kawamura¹, Takuro Masumura¹, Toshihiro Tsuchiyama¹, Yuzo Kawamoto²,
ONLINE Hiroyuki Shirahata², Ryuji Uemori¹
¹Kyushu University, Japan ²Nippon Steel Corporation, Japan

05-0270 Evolution of Carbides during the Pretreatment of AISI H13 Steel

16:20-16:40

Jie Zhou, Yue Ma, Qian Tong, Qisong Sun
ONLINE Shougang Group, China

05-0255 Relationship between Fatigue Strength and Microstructure of Carburized Steel Tempered at Different Temperature

16:40-17:00 **ONLINE** [Takuya Kita](#)¹, Hiroki Kamiya¹, Junya Asaoka¹, Goro Miyamoto², Tadashi Furuhashi²
¹DENSO Corporation, Japan ²Tohoku University, Japan

05-0225 Migrating Boundary Induced Plasticity in Polycrystalline Pure Iron: A Molecular Dynamics Approach

17:00-17:20 [Simoon Sung](#)¹, Jaehoon Jang², Hyerim Hwang³, Yanghoo Kim⁴, Heung Nam Han¹
¹Seoul National University, Korea ²Korea Institute of Materials Science, Korea ³Harvard University, USA
⁴Korea Institute of Industrial Technology, Korea

04 Rolling / Forging

TUESDAY, December 07

Room 204

Chair Qi Zhang (Xi'an Jiaotong University, China)

04-0381 Deformation of Center Porosity in Slab Rolling After Continuous Casting

09:00-09:20 [Nobuki Yukawa](#)¹, Yuta Morikawa¹, Eiji Abe¹, Shinji Nagai²
KEYNOTE ¹Nagoya University, Japan ²Nippon Steel Corporation, Japan

ONLINE

04-0841 A Shear Strain-Based Criterion for Reducing Surface Defects on the Stock in Bar Rolling and Applications

09:20-09:40 [Sangjin Lee](#)¹, Jinhwan Lee¹, Changhyun Wee¹, Yonghoon Roh², Dongjoon Kim², Youngseog Lee², Hongkil Moon¹
¹Hyundai Steel, Korea ²Chung-Ang University, Korea

04-0886 Numerical Simulation of the Partition Wall to Improve Energy Efficiency in a Reheating Furnace

09:40-10:00 [Seungjin Lee](#), Seongkyu See
POSCO, Korea

04-0222 Feedforward Control of Strip Hardness for Thickness Oscillation of Tandem Cold Mill Process

10:00-10:20 [Kyoung Sik Woo](#), Seung Min Hur
Hyundai Steel, Korea

03-2 Casting

TUESDAY, December 07

Room 204

Chair Jung-Wook Cho (Pohang University of Science and Technology, Korea)

03-1398 Improvement of Steel Properties via Equiaxed Grain Structure Formed during Solidification of Steels: Fine Tuning of Oxide-Nitride Multiphase Inclusions
10:40-11:00

KEYNOTE [Joohyun Park](#)
Hanyang University, Korea

03-0936 Mathematical Model on the Slag Entrainment during Steel Continuous Casting

11:00-11:20 [Wei Chen](#), Lifeng Zhang
ONLINE *Yanshan University, China*

03-1230 Influence of Tundish Flux on the Formation of Non-metallic Inclusions in Stainless Steel Melts during Continuous Casting Process

11:20-11:40 [Tae Sung Kim](#)¹, Sang-Beom Lee², Joo Hyun Park¹
¹*Hanyang University, Korea* ²*POSCO, Korea*

03-0336 Ladle Slide Gate – Collector Nozzle Performance Improvement by Avoiding Metal Sticking at Junction Area of Collector Nozzle & Ladle Shroud

11:40-12:00 [Sahin Ali](#)¹, Hiroshi Nagata¹, Gautam Kr Choudhury¹, [Aakash Dasari Sai](#)¹, Yasuaki Shin², Vishnu Manish Kumar¹
¹*TRL Krosaki Refractories Limited, India*, ²*TRL Krosaki Refractories Limited, Japan*

08 Artificial Intelligence / Smart Factory

TUESDAY, December 07

Room 204

Chairs Marie-Aline Van Ende (Seoul National University, Korea)
In-Ho Jung (Seoul National University, Korea)

08-1059 SeAH DT Journey to Smart Factory (On-site Centric DT Challenges Identification and Execution)

13:20-13:40 [Minseok Chae](#)
KEYNOTE *SeAH Changwon Special Steel, Korea*

08-0974 Data-driven Approaches in Materials Integration

13:40-14:00 [Masahiko Demura](#)
KEYNOTE *National Institute for Materials Science, Japan*
ONLINE

08-1264 Development of AI-assisted Mechanical Property Control System of Plate Steels

14:00-14:20 [Juseok Kang](#), Hyoshin Kim, Hwangyo Jung
POSCO, Korea

08-0457 Applications of Artificial Intelligence in Steel Making: Case Studies for Steel Hot Ductility Prediction and Image Analysis in BOF Process

KEYNOTE [Dae-Geun Hong](#)¹, Sang-Hum Kwon², Kyung-Chul Cho², Woong-Hee Han², Chang-Hee Yim¹
¹Pohang University of Science and Technology, Korea ²POSCO, Korea

08-1267 Large-scale Natural Pattern Generation Using AI for Color Steel Sheet

14:40-15:00 [Jihoon Na](#), Hyeonjung Kim
POSCO, Korea

08-0358 Intelligent Operation of Steel Production Processes by Integrating Machine Learning and Domain Knowledge

KEYNOTE [Manabu Kano](#)

 **ONLINE** *Kyoto University, Japan*

08 Artificial Intelligence / Smart Factory

TUESDAY, December 07

Room 204

Chairs Masahiko Demura (National Institute for Materials Science, Japan)
Dae-Geun Hong (Pohang University of Science and Technology, Korea)

08-0275 Data-Driven Approach for Development of Structural Materials

16:00-16:20 [Manabu Enoki](#)
KEYNOTE *The University of Tokyo, Japan*

 **ONLINE**

08-1332 Steelmaking Process Simulations Using FactSage Thermodynamic Databases and Applications to Smart Factory

16:20-16:40
KEYNOTE [Marie-Aline Van Ende](#), In-Ho Jung
Seoul National University, Korea

08-1028 The Development of AI Assisted Tensile Property Prediction Model and Optimal Experiment Condition in Cold Rolled Sheet Steel

16:40-17:00 [Donghui Kim](#), Yongwoo Kim
POSCO, Korea

08-0568 Deep Learning Structural Optimization of Dual-phase Steel Using Variational Autoencoder
 17:00-17:20 Hyoung Seop Kim¹, Hyung Keun Park¹, Jaimyun Jung², Jin You Kim³, Yongju Kim¹, Hwan Gyo Jung³
¹Pohang University of Science and Technology, Korea ²Korea Institute of Materials Science, Korea
³POSCO, Korea

08-0867 AI Technology-based Model to Forecast Mechanical Properties of Heavy Plate
 17:20-17:40 Jae-yoon Kim, Seung Jae Jo
 Hyundai Steel, Korea

08-0763 Vision Based Ladle Tracking System Using Deep Learning Algorithm
 17:40-18:00 Kang Won Lee, Hyoung Keun Choi
 Hyundai Steel, Korea

12 Advanced Automotive Steels (ASIC)

TUESDAY, December 07

Room 205

Chair Ji Hoon Kim (Pohang University of Science and Technology, Korea)

12-0171 Effect of Annealing Process on Microstructure Evolution and Mechanical Properties of DH980
 09:00-09:20 Yun Han
KEYNOTE Shougang Group Co., Ltd., China
 ☞ ONLINE

12-0830 Influence of Nb Addition on the Tensile Properties in Low C Multiphase Steels Subjected to Annealing at Different Temperatures
 09:20-09:40 Kang Hyun Choi¹, Dong-Woo Suh²
¹POSCO, Korea ²Pohang University of Science and Technology, Korea

12-0943 Effect of Subzero Treatment of Tensile Properties of Intercritically Annealed Steels
 09:40-10:00 GyungBae Park¹, JinKeun Oh², Alireza Zargaran³, Nack Joon Kim³
¹Korea Institute of Materials Science, Korea ²POSCO, Korea ³Pohang University of Science and Technology, Korea

12-0689 Effect of Electropulsing on Transformation Kinetics of Metastable Austenite and Bainite in Steel
 10:00-10:20 Munmun Agrawal¹, Debabrata Bhuyan¹, R. K. Pandey¹, A. Sharma², R. Manna¹
 ☞ ONLINE ¹Indian Institute of Technology, Banaras Hindu University, Varanasi, India ²Beam Technology Development Group, Bhabha Atomic Research Centre, Mumbai, India

12 Advanced Automotive Steels (ASIC)

TUESDAY, December 07

Room 205

Chair Young-Kook Lee (Yonsei University, Korea)

12-0159 Toughening Al-Si Coated Press-Hardened Steels (PHS) by Reducing Coating Thickness

10:40-11:00 Z. Wang¹, Z.H. Cao¹, J.F. Wang², M.X. Huang¹

KEYNOTE

¹The University of Hong Kong, Hong Kong ²General Motors China Science Lab, China

ONLINE

12-1308 Development of Non-Heat Treated Steel Adding Nb(+Ti) and BN Instead of Vanadium

11:00-11:20 Seungmin Lee, Hyongjun Lee, Junghun Seo, Sungwon Hong

SeAH Besteel, Korea

12-0725 Influence of Austenitizing Temperature on the Evolution of Microstructure and Mechanical Properties in a Dual-phase Medium Mn Steel

11:20-11:40 T. T. T. Trang, Yoon-Uk Heo

Pohang University of Science and Technology, Korea

ORAL
DEC 7

11 Hydrogen Embrittlement (ASIC)

TUESDAY, December 07

Room 205

Chairs Hyokyung Sung (Gyeongsang National University, Korea)
Motomichi Koyama (Tohoku University, Japan)

11-1195 Hydrogen Embrittlement of Thermally Hydrogen Charged STS304 at Low Temperature

13:00-13:20 Hanna Yang^{1,2}, Jaeyeong Park², Hyeongmin Heo², Un Bong Baek², Young-Kook Lee¹

¹Yonsei University, Korea ²Korea Research Institute of Standards and Science, Korea

11-0773 Effect of Microstructure on the Hydrogen Embrittlement of a Pearlitic Steel

13:20-13:40 Young-Kook Lee

KEYNOTE

Yonsei University, Korea

11-0959 Microstructural Aspects of Hydrogen Stress Cracking in High-strength Steel Welds

13:40-14:00 Hanji Park¹, Namhyun Kang¹, Cheolho Park², Junghoon Lee³, Stephen Liu⁴

KEYNOTE

¹Pusan National University, Korea ²Chosun University, Korea ³Yonsei University, Korea

⁴Colorado School of Mines, USA

11-1033 Effect of Hydrogen Diffusion and Twin Formation on Hydrogen Embrittlement of CoCrFeMnNi High-Entropy Alloy

14:00-14:20

Junghoon Lee¹, Namhyun Kang²

¹Yonsei University, Korea ²Pusan National University, Korea

11-1069 Hydrogen Embrittlement Susceptibility on High Strength Steel as Function of Tempering Temperature

14:20-14:40

Sourav Kr. Saha, Byungrok Moon, Jimin Nam, Namhyun Kang

Pusan National University, Korea

11-1178 Corrosion-induced Hydrogen Evolution, Absorption, and Cracking Behaviors of Zn-coated Ultra-high-strength Steel Sheets

14:40-15:00

Jin Sung Park¹, Seung-Pill Jung², Sung Jin Kim¹

¹Sunchon National University, Korea ²Hyundai Steel, Korea

11-1165 Effect of Alloy Composition Change on Hydrogen Embrittlement of Medium Carbon High Strength Bolt Steel for Offshore Plants

15:00-15:20

Byungrok Moon¹, Sourav Kr. Saha¹, Jimin Nam¹, Changhoon Lee², Junho Chung³, Namhyun Kang¹

¹Pusan National University, Korea ²Korea Institute of Materials Science, Korea ³Hyundai Steel, Korea

11-1150 Changes in Coating Layer and Hydrogen Absorption during Austenitization of Zn-Al Coated Medium-Mn Steel

15:20-15:40

Nu-Ri Cho, Jae-Hoon Nam, Young-Kook Lee

Yonsei University, Korea

11 Hydrogen Embrittlement (ASIC)

TUESDAY, December 07

Room 205

Chairs Namhyun Kang (Pusan National University, Korea)
M.X. Huang (The University of Hong Kong, Hong Kong)

11-0435 Effect of Alloy Carbides on the Hydrogen Embrittlement Resistance of Tempered Martensitic Steels

16:00-16:20

Hyun Joo Seo^{1,2}, Jang Woong Jo¹, Junmo Lee², Jae Nam Kim¹, Chong Soo Lee¹

KEYNOTE

¹Pohang University of Science and Technology, Korea ²POSCO, Korea

11-0154 Hydrogen Effects on Micro-Damage Arrest in Multiphase Steels

16:20-16:40

Motomichi Koyama¹, Milene Yumi Maeda^{1,2}, Chunxi Hao^{1,3}, Osvaldo Mitsuyuki Cintho², Kaneaki Tsuzaki^{4,5},

KEYNOTE

Tomohiko Hojo¹, Eiji Akiyama¹

ONLINE

¹Tohoku University, Japan ²State University of Ponta Grossa, Brazil ³Xi'an Jiaotong University, China

⁴Kyushu University, Japan ⁵National Institute for Materials Science, Japan

11-0954 The Resistance to Hydrogen Embrittlement of Martensitic Medium-Mn Steels

16:40-17:00 [Ahjeong Lyu](#), Jae-Hoon Nam, Minjeong Kim, Young-Kook Lee
Yonsei University, Korea

11-1212 Characteristics of Plastic Deformation to Hydrogen Embrittlement on Quenched and Partitioned (Q&P) Steel

17:00-17:20 [Hye-Jin Kim](#)¹, Myoung-Gyu Lee², Seung-Pill Jung¹, Hyun-Yeong Jung¹, Ju-Sik Hyun¹
¹*Hyundai Steel, Korea* ²*Seoul National University, Korea*

11-0668 Hierarchical Crack Growth Behavior in Hydrogen-assisted Quasi-cleavage Fracture in a Tempered Martensitic Steel

 **ONLINE** [Tingshu Chen](#)¹, Takahiro Chiba², Motomichi Koyama¹, Akinobu Shibata³, Eiji Akiyama¹, Kenichi Takai²
¹*Tohoku University, Japan* ²*Sophia University, Japan* ³*Kyoto University, Japan*

11-0487 Effect of Stress Mode on Hydrogen Embrittlement in Stable Austenitic Stainless Steels

17:40-18:00 [Hyung-Jun Cho](#), Sung-Joon Kim
Pohang University of Science and Technology, Korea

03-2 Casting

WEDNESDAY, December 08

Room 201

Chairs Seong-yeon Kim (POSCO, Korea)
Sohei Sukenaga (Tohoku University, Japan)

03-0249 Surface Quality Control of Compact Strip Casting – Optimization in the Mold09:00-09:20 Ce Liang, Lei Zhang, Wanlin Wang**KEYNOTE** *Central South University, China* **ONLINE****03-0473 Calculation of Initial Stage of Solidified Shell Deformation during γ to δ Transformation in Mold**09:20-09:40 Kohei Furumai¹, Andre Phillion², Hatem Zurob² **ONLINE** ¹*JFE Steel Corporation, Japan* ²*McMaster University, Canada***03-0525 Development of Inoculant Alloy for Grain Refinement by Direct Inoculation**09:40-10:00 Seongbeum Kim, Jung-Wook Cho*Pohang University of Science and Technology, Korea***03-1208 The Effect of Reduction on the Solidification Cavity Formation in High Carbon Steel**10:00-10:20 Sooyeon Lee¹, Ji-Yeon Jeong¹, Yoon-Uk Heo¹, Jae Sang Lee¹, Jong Kyo Choi², Myeong Hun Kang²,
Joo Dong Lee³, Chang Hee Yim¹¹*Pohang University of Science and Technology, Korea* ²*POSCO, Korea* ³*EXPRESSLAB Co., Ltd., Korea*

03-2 Casting

WEDNESDAY, December 08

Room 201

Chairs Youn-Bae Kang (Pohang University of Science and Technology, Korea)
Hideyuki Yasuda (Kyoto University, Japan)

03-0361 Understanding of Initial Solidification of Steel in Continuous Casting Obtained from POSCO's10:40-11:00 **Plant Tests****KEYNOTE** Seong-yeon Kim, Hyoung-Jun Lee, Sung-Suk Jung, Jun-Yong Park
*POSCO, Korea***03-1148 Hot Ductility Behavior of 9% Ni Containing Steel during Continuous Casting**11:00-11:20 Hyeju Kim, Seonguk Huh, Min Geol Kim, Sang-Hum Kwon, Yoon-Uk Heo, Jae Sang Lee, Chang Hee Yim
Pohang University of Science and Technology, Korea

03-1187 Effect of Thermal Cycle on Hot Ductility Behavior in High Nickel-Containing Steel

11:20-11:40 [Seonguk Huh](#)¹, Hyeju Kim¹, Sang-Hum Kwon², Soo-Chang Kang², Yoon-Uk Heo¹, Jae Sang Lee¹, Chang Hee Yim¹

¹Pohang University of Science and Technology, Korea ²POSCO, Korea

03-2 Casting

WEDNESDAY, December 08

Room 201

Chairs Il Sohn (Yonsei University, Korea)
Wanlin Wang (Central South University, China)

03-0448 Mechanism of Improvement on HAZ Toughness of Steel Plates with Mg Deoxidation after HHIW

13:20-13:40 [Jian Yang](#), Xiaoqian Pan, Longyun Xu, Yinhui Zhang, Dekun Liu

KEYNOTE Shanghai University, China

 ONLINE

03-0599 A Possible Mechanism of SEN Clogging for Ti-Added Ultra-Low C Steel Continuous Casting

13:40-14:00 [Youn-Bae Kang](#)¹, Joo-Hyeok Lee²

¹Pohang University of Science and Technology, Korea ²POSCO, Korea

03-0980 Kinetic Modeling of δ -ferrite Behavior in Continuously Cast 304 Austenitic Stainless Steel

14:00-14:20 [Tahereh Zargar](#)¹, Fazlollah Sadeghi¹, Jong Wan Kim², Yoon-Uk Heo¹, Jae Sang Lee¹, Chang Hee Yim¹

¹Pohang University of Science and Technology, Korea ²POSCO, Korea

03-0315 Reserch on Fluid Flow in Funnel-type Mold of Thin Slab with Thickness of 110mm in MCCR Line

14:20-14:40 [Ke Liu](#)¹, Qisong Sun¹, Chenzi Ji², Zhihong Tian¹

 ONLINE ¹Shougang Group Co., Ltd., China ²Shougang Jingtang United Iron & Steel Co., Ltd., China

03-0879 Effect of Optical Interaction between Glass and Dispersed Particles on Radiative Heat Transfer across Mould Flux

 ONLINE [Rie Endo](#), Chen Shiruo, Takashi Watanabe, Miyuki Hayashi, Masahiro Susa

Tokyo Institute of Technology, Japan

03-0607 Thermal Conductivity of Alkali Silicate Glasses and Melts

15:00-15:20 [Sohei Sukenaga](#)¹, Takahiko Endoh¹, Tsuyoshi Nishi², Sakiko Kawanishi¹, Hiromichi Ohta²,

 ONLINE Hiroyuki Shibata¹

¹Tohoku University, Japan ²Ibaraki University, Japan

03-2 Casting

WEDNESDAY, December 08

Room 201

Chairs Youngjo Kang (Dong-A University, Korea)
Jian Yang (Shanghai University, China)

03-0418 Time-resolved 2D and 3D Observation of Microstructure Evolution during Solidification and Subsequent Cooling in Steels

16:00-16:20

KEYNOTE Hideyuki Yasuda, Taka Narumi, Ryoji Katsube, Yukihiro Nanri, Sota Tsuji

ONLINE Kyoto University, Japan

03-0151 Tundish Process Performance Parameters and Metallurgical Evaluation of Industrial Scale Steelmaking Tundish Systems

16:20-16:40

KEYNOTE Dipak Mazumdar¹, Ankur Agnihotri²

ONLINE ¹Indian Institute of Handloom Technology, India ²Vardhman Special Steels Limited, India

03-0741 Inclusion Engineering in Advanced High Strength Steel: A Case Study of Deformation of Sulfide and Oxide Inclusions during Hot-rolling and Inclusion-microstructure Correlation in a Medium Mn Steel

16:40-17:00

ONLINE

Wangzhong Mu¹, Yonggang Yang^{1,2}, Yong Wang¹, Zhihua Dong^{1,3}, Joo Hyun Park^{1,4}, Zhenli Mi², Xinping Mao²
¹KTH Royal Institute of Technology, Sweden ²University of Science and Technology Beijing, China
³Chongqing University, China ⁴Hanyang University, Korea

03-0470 Evaluating the Effect of the Competition between NbC Precipitation and Grain Size Evolution on the Hot Ductility of Nb Containing Steels

17:00-17:20

ONLINE Kohei Furumai¹, Xiang Wang², Hatem Zurob², Andre Phillion²

¹JFE Steel Corporation, Japan ²McMaster University, Canada

03-1202 Review, Analysis and Modelling of Electromagnetic Stirring in Bloom Casting

17:20-17:40

Krashnavtar, Dipak Mazumdar

ONLINE Indian Institute of Technology Kanpur, India

03-1 Steelmaking

WEDNESDAY, December 08

Room 202

Chairs Wan-Yi Kim (Pohang University of Science and Technology, Korea)
Min Jiang (University of Science and Technology Beijing, China)

03-0928 Thermodynamics and Kinetics of Slag-Steel-Inclusion Reactions during Steelmaking Process

09:00-09:20

Lifeng Zhang¹, Ying Ren², Jujin Wang²

KEYNOTE ¹Yanshan University, China ²University of Science and Technology Beijing, China

ONLINE

03-0949 Effect of Si Content on the Morphology Control of MnS Sulfides in Free-cutting Stainless Steel

09:20-09:40 Chang Woo Seok¹, Ho Seung Kim², Youngjo Kang¹

¹Dong-A University, Korea ²SeAH Changwon Integrated Special Steel, Korea

03-0927 Transformation of LaAlO₃ Inclusions in a Solid Lanthanum-treated Aluminum-killed Steel

09:40-10:00 Qiang Ren, Xiaomin Kang, Julei Gao, Yujie Cheng, Lifeng Zhang

ONLINE Yanshan University, China

03-0514 Evaporation of Tramp Elements from Molten Iron during the BOF Process

10:00-10:20 Dong-Hyun Kim¹, Won-Bum Park¹, Sang-Chae Park², Youn-Bae Kang¹

ONLINE ¹Pohang University of Science and Technology, Korea ²POSCO, Korea

03-1 Steelmaking

WEDNESDAY, December 08

Room 202

Chairs Il Sohn (Yonsei University, Korea)
Noritaka Saito (Kyushu University, Japan)

03-0176 Important Issues on Control of Inclusions on Related to the Production of High-Quality Special Steels

10:40-11:00

KEYNOTE Min Jiang¹, Zewang Hou¹, Kunpeng Wang², Ying Wang², Xinhua Wang¹

ONLINE ¹University of Science and Technology Beijing, China ²Zenith Steel Group Co., Ltd., China

03-1004 Viscosity Evaluation of Simulated Foaming Slag Generated by Interfacial Reaction

11:00-11:20 Noritaka Saito, Yoshiyuki Egashira, Kunihiro Nakashima

ONLINE Kyushu University, Japan

03-0720 Thermodynamic Analysis of Oxidation Behavior of Boron in 9CrMoCoB Steel by

11:20-11:40 CaF₂-CaO-Al₂O₃-SiO₂-B₂O₃ Slag during the ESR Process

Shengchao Duan, Min-Joo Lee, Joo-Hyun Park

Hanyang University, Korea

03-0509 Numerical Study of Al Deoxidation Equilibrium of Fe-Cr-Ni Alloy

11:40-12:00 Hiroshi Fukaya¹, Seika Nakajima², Jonah Gamutan², Shigeru Suzuki¹, Koji Kajikawa¹, Ken Saito²,

ONLINE Takahiro Miki²

¹Japan Steel Works M&E, Inc., Japan ²Tohoku University, Japan

03-1 Steelmaking

WEDNESDAY, December 08

Room 202

Chairs Naoki Kikuchi (JFE Steel Corporation, Japan)
Jung-Wook Cho (Pohang University of Science and Technology, Korea)

03-0989 Recycling Technology for By-products of Stainless Steelmaking Process

13:20-13:40 Wan-Yi Kim

KEYNOTE POSCO, Korea

03-1244 Effect on Slag Composition on Evolution of Non-metallic Inclusions in Silicon-killed Stainless Steel Melts

13:40-14:00

Jinhyung Cho, Taesung Kim, Taesu Jeong, Joohyun Park
Hanyang University, Korea

03-0495 The Dissolution Behavior of Alumina Particle in Slag Melts Considering Ionic Structure of Slags

14:00-14:20

Joon Sung Choi¹, Cheol Min Yoon², Il Sohn², Dong Joon Min²
¹Research Institute of Industrial Science and Technology, Korea ²Yonsei University, Korea

03-0616 Evolution of Al₂TiO₅ Inclusions on the Steel Cleanliness during Secondary Refining Process

14:20-14:40

Young-Joon Park¹, Wan-Yi Kim², Youn-Bae Kang¹
¹Pohang University of Science and Technology, Korea ²POSCO, Korea

03-0932 Deformation of Inclusions and Its Effect on Steel Properties

14:40-15:00

Wen Yang¹, Lifeng Zhang², Ying Ren¹, Qiang Ren², Xianggui Jiang¹
¹ONLINE ¹University of Science and Technology Beijing, China ²Yanshan University, China

03-0894 Behavior of Oxygen in Fe-Ti Molten Alloy Containing High Concentration Ti at 1873K

15:00-15:20

Yong Woo Kim¹, Sun-Joong Kim¹, Min-Kyu Paek²
¹Chosun University, Korea ²Hanyang University, Korea

03-0533 Reoxidation Kinetics of Ultra Low Carbon Steel by RH Slag Containing Fe₂O₃: Reaction Mechanism and Reaction Rate Modelling

15:20-15:40

Yong-Min Cho¹, Woo-Yeol Cha², Youn-Bae Kang¹
¹Pohang University of Science and Technology, Korea ²POSCO, Korea

03-1 Steelmaking

WEDNESDAY, December 08

Room 202

Chairs Yongsug Chung (Korea Polytechnic University, Korea)
Wangzhong Mu (KTH Royal Institute of Technology in Stockholm, Sweden)

03-0185 A Study on Dephosphorisation Behaviour of Hot Metal in the BOF Using Calcium-Ferrite

16:00-16:20 [Tapas Kumar Roy](#)¹, [Saroj Kumar Singh](#)¹, [Prakash Gupta](#)¹, [Rahul Bhattacharya](#)¹,

KEYNOTE [Maheshbabu Harpanahalli](#)², [Akshay Khullar](#)¹

^(P) ONLINE ¹Tata Steel, Jamshedpur, India ²Tata Steel BSL, Angul, India

03-0404 Development of a Thermodynamic Model for Ladle Metallurgy Steel Making Process

16:20-16:40 [Prasenjit Singha](#), [Ajay Kumar Shukla](#)

^(P) ONLINE *Indian Institute of Technology Madras, India*

03-0993 Tracing of Non-metallic Inclusions in Secondary Metallurgy by Means of Rare Earth Elements

16:40-17:00 [Kathrin Thiele](#)¹, [Susanne Michelic](#)¹, [Roman Roessler](#)², [Sergiu Ilie](#)², [Alexander Penz](#)²

^(P) ONLINE ¹University of Leoben, Austria ²Voestalpine Stahl GmbH, Austria

03-0454 Control of MnS Inclusion Aspect Ratio in Lead Free Cutting Steels

17:00-17:20 [Soorya Prakash Jayaraj](#), [Kalaivani G](#), [Mohammed Rasul I](#), [Manjini Sambandam](#)

^(P) ONLINE *JSW Steel Limitid, Salem Works, India*

03-0146 Calculation of MnS Inclusion Formation Process in Axle Steel Ingot

17:20-17:40 [Naibing Lyu](#)

^(P) ONLINE *Shougang Group Co., Ltd., China*

03-1173 Effect of Gas Flow and Nozzle Pattern on Perfect Mixing Time Using Water Model

17:40-18:00 [Mi Ran Na](#), [Sun Joong Kim](#)

Chosun University, Korea

ORAL
DEC 8

06 Joining / Welding

WEDNESDAY, December 08

Room 203

Chair Yeongdo Park (Dong-Eui University, Korea)

06-0274 Challenges and Potential Solutions to Welding 3G AHSS during Automotive Assembly

09:00-09:20 [Elliot Biro](#)

KEYNOTE *University of Waterloo, Canada*

^(P) ONLINE

06-0941 Modeling of Subcritical Heat Affected Zone Tempering on 3G AHSS Spot Welds

09:20-09:40 [Dileep Ramachandran](#)¹, Abdelbaset R.H. Midawi¹, Ghassemi Armaki Hassan², Elliot Biro¹

 **ONLINE** ¹University of Waterloo, Canada ²General Motors, USA

06-1248 Effect of the Wire Feeding Directions on the Laser Braze Ability and Its Performances of the Galvanized Steel Sheet with Cu-Si Filler

09:40-10:00 [Mokyoung Lee](#), Duyoul Choi, Sangho Uhm, Dokyeong Han, Gyuyeol Bae, Sangman Yun
POSCO, Korea

06 Joining / Welding

WEDNESDAY, December 08

Room 203

Chair Seung-Joon Lee (Korea Polytechnic University, Korea)

06-0204 Application of Fused $\text{CaF}_2\text{-SiO}_2$ and $\text{CaF}_2\text{-SiO}_2\text{-MnO}$ Fluxes into EH36 Shipbuilding Steel Plates Subject to High Heat Input Submerged ARC Welding

10:40-11:00  **KEYNOTE** Jin Zhang, Yanyun Zhang, [Cong Wang](#)

 **ONLINE** *Northeastern University, China*

06-0742 Investigation of the Joint Strength and Failure Mode for the Arc Plug Welded Advanced High Strength Steels

11:00-11:20 Arun Lalachan¹, [Yeong-Do Park](#)¹, Anirudhan Binu Thondithalayil¹, Kyung Young Kim¹, Ji Young Shin¹, Sivaprasad Murugan¹, Han Ju Lee¹, Doo Young Kim², Ho Young Gong²
¹Dong-Eui University, Korea ²Hyundai Motor Company, Korea

06-1210 Effect of Segregation and Microstructure by Controlled Dual Beam of ARM Laser Welding in Al-Si-Coated Hot Stamping Boron Steel

11:20-11:40 [Changwook Ji](#), Hyun Uk Jun
Korea Institute of Industrial Technology, Korea

06-1038 Effect of Welding Current on Heterogeneous Distribution of Microstructure and Hardness in Resistance Spot Welded BH340 Steel

11:40-12:00 [Saurabh Pawar](#)¹, Abhishek Kumar Singh¹, Lalit Kaushik¹, Ki-Seong Park¹, Jae Hyeok Shim², Shi-Hoon Choi¹
¹Sunchon National University, Korea ²Korea Institute of Science and Technology, Korea

06 Joining / Welding

WEDNESDAY, December 08

Room 203

Chairs Changwook Ji (Korea Institute of Industrial Technology, Korea)
Xianchun Dong (Shougang Research Institute of Technology, China)

06-0353 Liquid Metal Embrittlement during the Resistance Spot Welding of Galvannealed Steels: Synergy of Liquid Zinc, α -Fe (Zn) and Thermal Gradient Induced Tensile Stress

13:20-13:40

KEYNOTE

Yeongdo Park¹, Arun Lalachan¹, Siva Prasad Murugan¹, Jiwoong Kim¹, Changyong Lee², Wanee Yug², Woosung Jin¹

¹Dong-Eui University, Korea ²Hyundai Steel, Korea

06-0847 The Effects of Coating Type on the Susceptibility to Liquid Metal Embrittlement during Resistance Spot Welding in Galvanized and Galvannealed Sheet Steels

13:40-14:00

Wan Yook, Young-Min Lim, Woo-Jin Kim, Min-Ho Jang, Joung-Hyun La, Chang-Yong Lee
Hyundai Steel, Korea

06-0808 Si Effect on Zn-assisted Liquid Metal Embrittlement in Advanced High Strength Steels

14:00-14:20

Seok-Hyun Hong¹, Doyub Kim¹, Jee-Hyun Kang², Sung-Joon Kim¹

¹Pohang University of Science and Technology, Korea ²Yeungnam University, Korea

06-0769 Enhanced Toughness of Medium-Mn Steel after Friction Stir Welding

14:20-14:40

Seung-Joon Lee¹, Mun Sik Jeong², Jeongho Han², Pyuck-Pa Choi³, Hidetoshi Fujii⁴

¹Korea Polytechnic University, Korea ²Hanyang University, Korea ³Korea Advanced Institute of Science and Technology, Korea ⁴Osaka University, Japan

06-1018 Joining of Steel and Aluminum Alloys by Friction Stir Welding: A Study on the Microstructural Evolution and Electrochemical Behavior

14:40-15:00

Sam Yaw Anaman¹, Hrishikesh Das², Sung-Il Baik³, Jong-Sook Lee⁴, Sung-Tae Hong², Hoon-Hwe Cho¹

¹Hanbat National University, Korea ²University of Ulsan, Korea ³Northwestern University, USA

⁴Chonnam National University, Korea

06-0745 Performance of Ti, Nb Precipitates in HAZ and Effect on Carbon Equivalent

15:00-15:20

Xianchun Dong, Fenghui Wang, Yingjian Zhao, Ning Cai

^{ONLINE} Shougang Research Institute of Technology, China

05 Joining / Welding

WEDNESDAY, December 08

Room 203

Chair Yeongdo Park (Dong-Eui University, Korea)

06-0349 Improvement of Interfacial Strength of Al/Fe Dissimilar Weld by Addition of Alloying Elements

16:00-16:20 Shun Omura¹, Hiroki Furuya¹, [Yutaka Sato](#)¹, Yujiro Tatsumi²

KEYNOTE ¹Tohoku University, Japan ²Nippon Steel Corporation, Japan

 ONLINE

06-0812 Effect of Alloying Elements on the Impact Toughness of Coarse Grained Heat Affected Zone for Large Heat Input

16:20-16:40

[Jaehong Yoo](#), Youngjun Kim, Junmoo Song, Youngwook Jo

Hyundai Steel, Korea

06-0691 Influence of Bainitic Microstructure with M-A Constituent on Crack Propagation Behavior in the ICCGHAZ of HSLA Steels for Offshore Applications

16:40-17:00

[Savyasachi Nellikode](#)¹, Yeong-Do Park¹, Seung Jin Jung², In Chan Kim², Joonoh Moon³,

Chang-Hoon Lee³, Siva Prasad Murugan¹, Young-Gon Back¹

¹Dong-Eui University, Korea ²Chosun Welding Co., Ltd., Korea ³Korea Institute of Materials Science, Korea

06-0460 Application of Thermochemical Modelling to Predict Weld Metal Compositions in SAW

17:00-17:20

[Theresa Coetsee](#)¹, Chris Pistorius²

 ONLINE ¹University of Pretoria, South Africa ²Carnegie Mellon University, USA

06-0641 A Study on the Characteristics of Sulfide Stress Cracking in Full-Thickness of Pipeline Steel

17:20-17:40

[Minseok Kang](#), Hongyeol Bae, Woohyun Song

POSCO, Korea

10 Surface Engineering (jointed with ASIC)

WEDNESDAY, December 08

Room 204

Chairs Monojit Dutta (Tata Steel Ltd., India)
Yongsug Chung (Korea Polytechnic University, Korea)

10-0169 Recent Technologies and Applications of Batch Type Hot Dip Galvanizing

10:40-11:00

[Hiroshi Shibayama](#)

KEYNOTE Japan Galvanizers Association, Japan

 ONLINE

10-0567 Enrichment Behavior of Alloy Elements between Coating and Substrate of Dual Phase Steel

11:00-11:20 [Yan Li¹](#), Tiejun Li², Huaxiang Teng¹, Guangrui Jiang¹, Yun Han¹

ONLINE ¹Shougang Group Co., Ltd., China ²Shougang Institute of Technology, China

10-1412 Galvanizability Improvement of Advanced High Strength Steels through Internal Oxidation

11:20-11:40 **Technology**

[Kicheol Kang](#), Minhyeok Kwon, Doyub Kim, Yongkyun Cho

POSCO, Korea

10-0682 A Study on the Removal of Internal Oxidation of Hot Rolled Steel Sheet in Pickling Process

11:40-12:00 [Hyoungkuk Park](#)

POSCO, Korea

10 Surface Engineering (jointed with ASIC)

WEDNESDAY, December 08

Room 204

Chair [Kicheol Kang](#) (POSCO, Korea)

10-0211 Development of Amorphous Ni-P Coating over API X70 Steel for the Prevention of Hydrogen Embrittlement

13:20-13:40

KEYNOTE

[Santigopal Samanta¹](#), Kallol Mondal², Shiv Brat Singh³, [Monojit Dutta¹](#)

ONLINE ¹Tata Steel Ltd., India ²Indian Institute of Technology, Kanpur, India ³Indian Institute of Technology, Kharagpur, India

10-0386 Recent Issues of Surface Characteristics and Performance of High Strength Steel

13:40-14:00 [Yonkyun Song](#)

KEYNOTE

POSCO, Korea

10-0620 Effect of Lanthanum Addition for the Oxidation Behaviors and Related Area Specific Resistance in Ferritic Stainless Steels for Solid Oxide Fuel Cell Interconnects

14:00-14:20

[Yoon Seok Ko¹](#), Dong-Ik Kim¹, Heung Nam Han²

¹Korea Institute of Science and Technology, Korea ²Seoul National University, Korea

10-1263 Introduction to PosMAC® - Advanced Anti-corrosion Coated Steel

14:20-14:40 [Il Ryoung Sohn](#)

POSCO, Korea

10-1404 Introduction to Characteristics of Hot-dip ZnMgAl Coatings with Ultra-high Corrosion Resistance

14:40-15:00

[Sungjoo Kim](#)

POSCO, Korea

08 Artificial Intelligence / Smart Factory

WEDNESDAY, December 08

Room 204

Chair Sun-Joong Kim (Chosun University, Korea)

08-0512 Bayesian Probabilistic Modeling of Stacking Fault Energy in Austenitic Stainless Steels

16:00-16:20 [Han-Seop Noh](#), Man-Jin Ha
POSCO, Korea

08-0591 Reheating Furnace Scheduling with Consideration of Empty Space and Slab Temperature

16:20-16:40 [Jungkyu Kim](#)
POSCO, Korea

08-0234 Determination of Plastic Properties of Metallic Materials Using Neural Network Combined with Finite Element Simulation of Indentation

16:40-17:00 [Kyeongjae Jeong](#), Hyukjae Lee, Oh Min Kwon, Jinwook Jung, Dongil Kwon, Heung Nam Han
Seoul National University, Korea

08-0671 Predicting Flow Behavior from Nanoindentation Test by Artificial Neural Network Model

17:00-17:20 [Jin Myoung Jeon](#), Kyo Jun Hwang, Heung Nam Han, Dae-Geun Hong, Hyoung Seop Kim, Jung-Wook Cho
Pohang University of Science and Technology, Korea

12 Advanced Automotive Steels (ASIC)

WEDNESDAY, December 08

Room 205

Chair Dong-Woo Suh (Pohang University of Science and Technology, Korea)

12-0382 Flash Annealing of Advanced High Strength Steels: Phase Transformations and Mechanical Behavior

09:00-09:20 **KEYNOTE** [Hao Chen](#)

^(*) ONLINE *Tsinghua University, China*

12-0882 Tuning the Microstructure and Mechanical Properties of B2-strengthened Lightweight Steels

09:20-09:40 [Alireza Zargaran](#), Gyeongbae Park, T.T.T. Trang, Nack J. Kim
KEYNOTE *Pohang University of Science and Technology, Korea*

12-0341 Low Alloy Ultra-High Strength Hot Forming Steel

09:40-10:00 [Nemai Chandra Gorain](#)¹, Anil Kumar Verma¹, B Ravi Kumar²
^(*) ONLINE ¹Tata Steel Ltd, India ²CSIR-National Metallurgical Laboratory, India

12-1262 Toward Strong and Tough Gigasteel Welds

10:00-10:20 [Gyuyeol Bae](#)

POSCO, Korea

12 Advanced Automotive Steels (ASIC)

WEDNESDAY, December 08

Room 205

Chair Yoon-Uk Heo (Pohang University of Science and Technology, Korea)

12-1227 Influence of Nano-sized Austenite on the Tensile Properties of As-quenched Martensite

10:40-11:00 Ji-Hoon Kim¹, Guiyoung Gu¹, Seok-Hwan Hong¹, Minseo Koo², Eun-Young Kim², [Dong-Woo Suh](#)¹

KEYNOTE

¹*Pohang University of Science and Technology, Korea* ²*POSCO, Korea*

12-1255 The Effect of Bainite and Martensite Microstructure on the Mechanical Properties of Automotive Giga Steels

11:00-11:20

[Young-Roc Im](#)¹, Eun-Young Kim¹, Taejin Song¹, Jae Sang Lee², Dong-Woo Suh²

¹*POSCO, Korea* ²*Pohang University of Science and Technology, Korea*

12-1052 Development of Martensitic Steel with GIGA Strength in Thin Hot-rolled Strip

11:20-11:40

[Kyong Su Park](#), Chang Young Son, Yung Kug Kwon, Seok Jong Seo

POSCO, Korea

12-1022 Quenching and Partitioning from Manganese Partitioned Pearlite: Retained Austenite Modification and Formability Improvement

11:40-12:00

ONLINE [Chao Zhang](#), Zhiping Xiong

Beijing Institute of Technology, China

12 Advanced Automotive Steels (ASIC)

WEDNESDAY, December 08

Room 205

Chairs Hao Chen (Tsinghua University, China)
Kyong Su Park (POSCO, Korea)

12-0863 Effects of Cooling Conditions on Microstructure and Mechanical Properties of Fe-Mn-Al-C Light-weight Steels

13:20-13:40

KEYNOTE

[Seong-Jun Park](#)¹, Kyeong-Won Kim¹, Joonoh Moon¹, Jun Young Park¹, Tae-Ha Kim², Kyeongjae Jeong³, Heung Nam Han³, Jong-Ho Shin⁴

¹*Korea Institute of Materials Science, Korea* ²*Korea Refractories Co., Ltd., Korea* ³*Seoul National University, Korea* ⁴*Doosan Heavy Industries and Construction, Korea*

12-1014 The Role of Slow Heating in Tailoring Metastable Austenite by Chemical Heterogeneity in a Medium Manganese Steel

13:40-14:00 **ONLINE** [Dezhen Yang](#), Zhiping Xiong
Beijing Institute of Technology, China

12-0904 Discussion on Upper Yield Point in Polycrystalline Ferritic Steel Based on the Critical Grain Boundary Shear Stress

14:00-14:20 **ONLINE** [Toshihiro Tsuchiyama](#)
Kyushu University, Japan

12-0892 Rapid Formation of Ultrafine UFG Ferrite + Austenite Structure with 1500MPa-30% from Ferrite + Mn Rich Cementite Prior Structure, Cementite Metallurgy

14:20-14:40 **ONLINE** [Shiro Torizuka](#)
University of Hyogo, Japan

12-0872 Development of Press Hardening Steel in POSCO

14:40-15:00 [Sang-Heon Kim](#), Jinkeun Oh, Seongwoo Kim, Seawoong Lee, Sang-Ho Han
POSCO, Korea

12-0758 Development of 1.5GPa Grade MS Steel with Excellent Bendability

15:00-15:20 [Bong June Park](#), Seon Hyeong Na, Sang-Wook Lee, Seong Kyung Han
Hyundai Steel, Korea

12-0753 Segregation and Local Partitoning of Mn at Migrating Ferrite / Austenite Interface

15:20-15:40 [Goro Miyamoto](#)¹, Tomoki Harada², Tadashi Furuvara¹
ONLINE ¹Tohoku University, Japan ²DENSO Corporation, Japan

12 Advanced Automotive Steels (ASIC)

WEDNESDAY, December 08

Room 205

Chairs [Hyun-Uk Hong](#) (Changwon National University, Korea)
[Alireza Zargaran](#) (Pohang University of Science and Technology, Korea)

12-0469 Coating-free High-performance Press Hardening Steel

16:00-16:20 [Qi Lu](#)¹, Zhisong Chai², Qingquan Lai³, Wei Xu², Jianfeng Wang¹

KEYNOTE ¹General Motors, China ²Northeastern University, China ³Nanjing University of Science and Technology, China

ONLINE

12-0811 Effect of Alloying Element on Phase Transformation in Fe-0.3N Alloy

16:20-16:40 [Mitsutaka Sato](#), Goro Miyamoto, Tadashi Furuvara

ONLINE *Tohoku University, Japan*

12-0708 Elemental Partitioning to κ -carbide/ γ -matrix and Its Effect on Strengthening in Ni-added

16:40-17:00 **Fe-Mn-Al-C Lightweight Steel**

Chiwon Kim¹, Jae Hoon Jang², Seong-Jun Park², Joonoh Moon², Chang-Hoon Lee², Bong Ho Lee³,
Hyun-Uk Hong¹

¹Changwon National University, Korea ²Korea Institute of Materials Science, Korea ³Daegu Gyeongbuk
Institute of Science and Technology, Korea

12-0695 Development of Eco-friendly Graphite Free Cutting Steel

17:00-17:20 Sangwoo Choi

POSCO, Korea

12-0627 Influence of Martensitic Microstructures on Bendability for 1.8gpa-class Ultra-high-strength

17:20-17:40 **Hot Stamped Steel**

Byung-Gil Yoo¹, Jewoosoo Kim¹, Hye Jin Kim¹, Seok-Hyeon Kang¹, Hyeong Hyeop Do¹,
Seong Kyung Han¹, Jae-il Jang², Seong Ju Kim¹

¹Hyundai Steel, Korea ²Hanyang University, Korea

12-0294 Precipitation of Nb and V in 60Si2CrV Spring Steel

17:40-18:00 Jie Zhou, Yuelin Chao, Qisong Sun, Quanli Wang

^(*) ONLINE Shougang Group, China

Poster Presentation

OFFLINE 12:40-13:20, TUESDAY, December 07 | Lobby (2F)

ONLINE 24 hours (Virtual Website)

Chairs
Youngjo Kang (Dong-A University, Korea)
Jee-Hyun Kang (Yeongnam University, Korea)
Sun-Joong Kim (Chosun University, Korea)
Jin-Kyung Kim (Hanyang University, Korea)
Hyokyung Sung (Gyeongsang National University, Korea)

01 Raw Materials / Ironmaking / Direct Reduction

01-0650 Effect of Oxygen Enrichment on Pollutant Emission of Flue Gas in Sintering Process

 **ONLINE** [Yapeng Zhang](#)^{1,2}, Wen Pan^{1,2}, Shaoguo Chen^{1,2}, Huaiping Ma^{1,2}, Zhixing Zhao¹
¹Shougang Group Co., Ltd., China ²Beijing Key Laboratory of Green Recyclable Process for Iron & Steel Production Technology, China

01-1279 Estimation of Viscosity of Synthetic Blast Furnace Slag with Low MgO Content

[Hye Ran Lee](#)¹, Byong Chul Kim², Han Sang Oh², Yun Mo Lee², Youngjo Kang¹
¹Dong-A University, Korea ²Hyundai Steel, Korea

01-1393 High Pellet Burden Operation in Blast Furnace at JSW Steel Limited

 **ONLINE** [A.V.R. Prabhakar Dasu](#), Mohanraj Nagarajan, Shiva Kumar, Sureshraj Voonna, Naveen Singh, Srinivas Rao, Lokendraraj Singh
JSW Steel Ltd, India

01-1403 Effect of K₂CO₃ on the Physicochemical Properties of Goethite Composite Pellet with Varying Basicity (CaO/SiO₂)

[Taehyeon Kim](#), Il Sohn
Yonsei University, Korea

02 Environmental Engineering

02-1055 Zn Stream Balance Model in the FINEX® Process

[Wonbum Park](#)¹, Moo-Eob Choi², Do-Hyung Kim², Youn-Bae Kang¹
¹Pohang University of Science and Technology, Korea ²POSCO, Korea

02-1354 Review of Hydrogen Reduction for HYBRIT & COURSE50

[Han Gyeol Kim](#), Il Sohn
Yonsei University, Korea

02-1359 Electrolytic Removal of Cd from ZnCl₂-NaCl-KCl Melt

 **ONLINE** [Daiki Fujimoto](#), Hiroyuki Matsuura
The University of Tokyo, Japan

03 Steelmaking / Casting

- 03-0417** Effects of Li_2O on the Crystallization of $\text{CaO-SiO}_2\text{-CaF}_2$ -based Mold Flux and Molecular Dynamics Simulation Analysis
Tae-Min Yeo, Jin-Mmyoung Jeon, Jung-Wook Cho
Pohang University of Science and Technology, Korea
- 03-0548** Quantitative Relation of Applied Electricity and Electrochemical Desulfurization of Molten Iron Using Molten Sag
Dong-Hyun Kim^{1,2}, Youn-Bae Kang¹
¹*Pohang University of Science and Technology, Korea* ²*Polytechnique Montréal, Canada*
- 03-0854** Effect of Rare-earth Treatment on Mechanical Properties of High Strength Low Alloy Wheel Steel
ONLINE Xiao-Jing Shao, Wen-Liang Dong, Hong-Yan Zhang
Shougang Group Co., Ltd., China
- 03-1031** Corrosion Behavior of MgO-C Refractory in Electric Arc Furnace Slag with Flux Added
Beomshin Park, Yongsug Chung, InJun Hwang
Korea Polytechnic University, Korea
- 03-1035** Wetting Characteristics Study of MgO-SiO_2 Slag and Magnesia-based Refractory
Seungwon Jeon, Yongsug Chung
Korea Polytechnic University, Korea
- 03-1043** Wetting and Spreading Kinetics between Liquid CaO-SiO_2 Slags and a Solid SiO_2
Jaewoo Myung, Chaeyeon Yoo, Yongsug Chung
Korea Polytechnic University, Korea
- 03-1065** Effect of Carbon Content of MgO-C on $\text{CaO-SiO}_2\text{-Al}_2\text{O}_3$ Slag Dissolution Behavior
Seungwook Lee, Yongsug Chung
Korea Polytechnic University, Korea
- 03-1084** The Effect of Alumina Activity on Dissolution Behavior of Alumina Particle in $\text{CaO-Al}_2\text{O}_3\text{-SiO}_2$ Slags
Sangrok Yeo, Yongsug Chung
Korea Polytechnic University, Korea
- 03-1175** Influence of Ca Addition on the Formation of Inclusions by Coupled Reaction Model
Eun San Jo, Sun-Joong Kim
Chosun University, Korea

03-1271 Control of Optimum Argon Shrouding Practice – A Water Model Study

“ONLINE Soorya Prakash Jayaraj¹, Viswanathan N Nurni², Kalaivani Ganesh¹, Manjini Sambandam¹
¹JSW Steel Ltd., Salem Works, India ²Indian Institute of Technology Bombay, India

03-1317 An Efficient Deoxidiser for Steel

“ONLINE Shashank Shekhar¹, Sarbendu Sanyal¹, Raghavendra Raju¹, Sambhunath Chakraborty², J B Singh¹
¹Jamipol Limited, India ²Jamipol Limited, Iran

03-1361 Study on Analysis of Post Combustion in a Converter Simulator under Carbon Burdened Condition

Jia Lee¹, Chang-Su Ha², Jeong-Whan Han¹
¹Inha University, Korea ²POSCO, Korea

03-1382 A Study on the Behavior of Nonmetallic Inclusions in Fe-1.5Al vs Fe-3Si Molten Steel

Dong Woon Kim, Joo Hyun Park, Tae Sung Kim
 Hanyang University, Korea

04 Rolling / Forging

04-1342 Development of Multi-layered Cold Roll Forging Process for Improved Accident Tolerant Fuel Cladding in Light Water Reactors

Jongwoo Kim, Hyeongwoo Min, Jihyeok Choi, Heonghye Jo, Youngah Park, Youngsoo Yoon
 Gachon University, Korea

05 Thermomechanical Treatment

05-0573 Introduction of Resetting Process into Medium-Mn Steel to Recover the Ductility Reduced by Cold Working

Mun Sik Jeong¹, Tak Min Park¹, Seunggyu Choi², Seok-Jae Lee², Jeongho Han¹
¹Hanyang University, Korea ²Jeonbuk National University, Korea

05-0575 Novel Cryogenic Impact Toughness of 200 J in Low-Ni Martensitic Steels

Hyun Wook Lee, Tak Min Park, Jeongho Han
 Hanyang University, Korea

05-0684 Numerical Simulation and Experimental Validation of MnS Precipitation in Non Oriented Electrical Steel

Sung-Ho Kim¹, Hojun Gwon¹, Seil Lee², Sung-Joon Kim¹
¹Pohang University of Science and Technology, Korea ²POSCO, Korea

- 05-0703** **Microstructure and Low-Temperature Toughness of Fe-6.5Mn-0.08C Medium-Manganese Steel**
Young-Chul Yoon, Sang-In Lee, Dong-Kyu Oh, Byoungchul Hwang
Seoul National University of Science and Technology, Korea
- 05-0747** **Microstructures, Precipitation Behavior, and Mechanical Properties of the Low Carbon Medium-Manganese Steel Micro-Alloyed with Ni and Al upon Various Heat Treatment Route**
Jinyoung Kim, Jinkyung Kim
Hanyang University, Korea
- 05-0750** **Design of the Room-temperature Quenching and Aging Medium Mn Steel**
Donggyun You, Jinkyung Kim
Hanyang University, Korea
- 05-0821** **Effect of near Ac3 Annealing on the Microstructures and Mechanical Properties of the Medium Mn Steels**
Junik Song, Jin-Kyung Kim
Hanyang University, Korea
- 05-1076** **Adjusting the Thermomechanical Condition to Change the Microstructure of C-Mn Cold Heading Quality Steel for Rapid Cementite Spheroidization at Subcritical Temperature**
Kyu-Sik Kim¹, Jung-Uk Lee¹, Dong-Yeol Wi¹, Jae-Seung Lee², Kee-Ahn Lee¹
¹Inha University, Korea ²POSCO, Korea
- 05-1143** **The Correlation between Microstructure and Mechanical Properties of High Strength Steel after Heat Treatment**
Minha Park^{1,2}, Moonseok Kang^{1,2}, Geon-Woo Park¹, Hyoung-Seok Moon¹, Byung Jun Kim¹
¹Korea Institute of Industrial Technology, Korea ²Pusan National University, Korea
- 05-1269** **Development of Ultra-High Strength Co-Free Low-Cost Maraging Steel**
Timothy Listyawan, Myeong Hyeon Jang, Nokeun Park
Yeungnam University, Korea

06 Joining / Welding

- 06-0987** **The Correlation between Microstructure and Mechanical Properties of Welded High-Mn Austenitic Steels after Post Weld Heat Treatment**
Minha Park^{1,2}, Moonseok Kang^{1,2}, Gwangjoo Jang¹, Byoungkoo Kim¹, Byung Jun Kim¹
¹Korea Institute of Industrial Technology, Korea ²Pusan National University, Korea

06-1079 Heat Treatment Effect on the Microstructure, Mechanical Properties of AISI D2 Tool Steel Fabricated by Direct Energy Deposition

Jung-Hyun Park¹, Kyu-Sik Kim¹, Jin-Young Kim², Yong-Mo Koo³, Kee-Ahn Lee¹

¹Inha University, Korea ²Maxrotech corporation, Korea ³Chang Sung Corporation, Korea

06-1158 The Influence of Post Weld Heat Treatment on Microstructure and Mechanical Properties of Submerged Arc Welded X70 Steels

Minha Park, Moonseok Kang, Gwangjoo Jang, Hyoung-Chan Kim, Byung Jun Kim

Korea Institute of Industrial Technology, Korea

06-1200 Evaluation of Microstructure and Impact Toughness Properties of Multi-welds in HSLA High-strength Steel

Byeong-Chan Choi^{1,2}, Sang Joon Lee¹, Byung-Jun Kim¹, Hyoung-Seok Moon¹, Byoung-Koo Kim¹, Yang Do Kim², Hyoung-Chan Kim¹

¹Korea Institute of Industrial Technology, Korea ²Pusan National University, Korea

06-1356 A New Observation of Hetero-Epitaxial Nucleation from TiN during Gas Tungsten Arc Welding of Oxide Metallurgy-Processed Ferritic Stainless Steel

Dongmin Kim¹, Jiun Park¹, Hyunuk Hong¹, Youngtae Cho¹, Wonbae Lee²

¹Changwon National University, Korea ²POSCO, Korea

06-1367 The Effect of Ti addition and Welding Process on Microstructures and High-temperature Mechanical Properties in RAFM Steel

Tae Yeong Kim¹, Tae Hoon Kim¹, Joonoh Moon², Chang Hoon Lee², Hyun Uk Hong¹

¹Changwon National University, Korea ²Korea Institute of Materials Science, Korea

07 Analysis / Instrumentation

07-0570 Strain Analysis of Trip-aided Steel Using Digital Image Correlation without Artificial Patterns

Kyung Il Kim¹, Yeonju Oh², Joo-Hee Kang³, Gue Serb Cho¹, Kyu Hwan Oh², Jun-Yun Kang³, Heung Nam Han²

¹Korea Institute of Industrial Technology, Korea ²Seoul National University, Korea ³Korea Institute of Materials Science, Korea

07-0623 Near-atomic Observation of Passive Films Formed on a High Cr-added 18wt% Mn TWIP Steel and Typical Austenitic Stainless Steels

Kwang Kyu Ko, Muhammad Ishtiaq, Hyo Ju Bae, Eunhye Park, Hyokyung Sung, Jung Gi Kim, Jae Bok Seol

Gyeongsang National University, Korea

07-0652 Evolution of Microstructure and Mechanical Prosperities during Aging Treatment of AN FE-MN-AL-C Austenitic Lightweight Steel

Dongwon Lee¹, Seong-Jun Park², Jae Sang Lee¹, Yoon-Uk Heo¹

¹Pohang University of Science and Technology, Korea ²Korea Institute of Materials Science, Korea

07-0693 Evolution of Microstructure and Tensile Property in AN Fe-Mn-Si-C Alloy depending on the Different Heat-Treatment Cycles

Chang Gon Jeong¹, Eun Yoo Yoon², Young Seon Lee², Yoon Uk Heo¹

¹Pohang University of Science and Technology, Korea ²Korea institute for Materials Science, Korea

07-1090 Sub-structure and Precipitation Behavior of Lenticular Martensite in AISI-440C Steel

 **ONLINE** Jia-Jun Chen, Jer-Ren Yang

National Taiwan University, Taiwan

07-1094 Investigation of Strain-induced Precipitation of Niobium Carbide in Niobium Micro-alloyed Steels at Elevated Temperature.

 **ONLINE**

Tzu-Ching Tsao, Jer-Ren Yang

National Taiwan University, Taiwan

07-1097 Deformed Structure of Massive Ferrite in an Interstitial Free Steel under Uniaxial Tensile Test

 **ONLINE** Shih Yuan Lu¹, Banjemin Pei-Herng Liu², Jer-Ren Yang¹

¹National Taiwan University, Taiwan ²China Steel Corporation, Taiwan

07-1140 Microstructures and Crystallography Analysis of Lath Martensite in Three Different Zone Axis in 22MnB5 Steel

 **ONLINE**

Cheng Ling Tai, Ming Yi Cheng, Jer Ren Yang

National Taiwan University, Taiwan

07-1154 Effects of Low Temperature Austempering on the Microstructure Evolution and Mechanical Properties of Carbide-Free Bainite

 **ONLINE**

Po Han Chiu, Yu Wei Lai, Jer Ren Yang

National Taiwan University, Taiwan

07-1373 Investigation of Mechanical Properties and Microstructure upon Dynamic Strain Aging of Type 316L Stainless Steel

Tae-Hun Kim¹, Tae-Yeong Kim¹, Woo-Gon Kim², Hyeong-Yeon Lee², Hyun-Uk Hong¹

¹Changwon National University, Korea ²Korea Atomic Energy Research Institute, Korea

08 Artificial Intelligence / Smart Factory

- 08-0833** The Development of Interstand-tension Estimation Methods in Bar Mill
Sanghyeon Lee, Sangjin Lee, Changhyun Wee, Hongkil Moon
Hyundai Steel, Korea
- 08-1207** Application of Robotic Process Automation to Academic Research: from Raw Data to Presentation Slides
Hyeonwoo Park, Hansoo Kim, Kijang Oh, Joonho Lee
Korea University, Korea

10 Surface Engineering (jointed with ASIC)

- 10-0503** Effect of Phosphate on Crystallization Behavior of Silica in Tension Coating of Grain-Oriented Electrical Steel
Min Soo Han
POSCO, Korea
- 10-1362** A Study on Corrosion Durability Improvement of CrAl Coated Metal Bipolar Plate for PEMFC by 3D Laser Cladding Coating Method
Haeun Kang¹, Youngeun Park¹, Hyeonwoo Min¹, Jisu Na¹, Hyungil Kim², Youngsoo Yoon¹
¹Gachon University, Korea ²Korea Atomic Energy Research Institute, Korea

11 Hydrogen Embrittlement (ASIC)

- 11-0630** The Relationship between Micro-alloying and Hydrogen Embrittlement Resistance of Medium Mn Steels
Tak Min Park¹, Hye-Jin Kim², Ho Yong Um², Nam Hoon Goo², Jeongho Han¹
¹Hanyang University, Korea ²Hyundai Steel, Korea
- 11-0685** Machine Learning for Hydrogen Environmental Embrittlement Index of Austenitic Steels
Seung-Hyeok Shin, Sang-Gyu Kim, Byoungchul Hwang
Seoul National University of Science and Technology, Korea
- 11-1168** Hydrogen Embrittlement of Thermally H-charged Stainless Steels at Low Temperature
Jaeyeon Park, Hyeonmin Heo, Hanna Yang, Un Bong Baek
Korea Research Institute of Standards and Science, Korea

11-1274 Evaluation of Hydrogen Embrittlement of Pre-strained AISI 316L Austenitic Stainless Steel Using Synchrotron Radiation

ONLINE

Marcel Tadashi Izumi¹, Mauricio de Castro¹, Ana Luísa Terasawa Senra¹, Letícia Falcão Starck¹, Milene Yumi Maeda¹, Ricardo Sanson Namur¹, Pedro da Silva Craidy², Osvaldo Mitsuyuki Cintho¹
¹State University of Ponta Grossa, Brazil ²Petrobras Research Center, Brazil

11-1278 Evaluation of Hydrogen Embrittlement of Pre-strained AISI 304 Austenitic Stainless Steel Using Synchrotron Radiation

ONLINE

Marcel Tadashi Izumi¹, Mauricio de Castro¹, Ana Luísa Terasawa Senra¹, Letícia Falcão Starck¹, Milene Yumi Maeda¹, Ricardo Sanson Namur¹, Pedro da Silva Craidy², Osvaldo Mitsuyuki Cintho¹
¹State University of Ponta Grossa, Brazil ²Petrobras Research Center, Brazil

11-1284 The Effect of Surface Roughness on Hydrogen Embrittlement of High Manganese Steel

Irfan Fawaz Prabowo, Jee-Hyun Kang
Yeungnam University, Korea

11-1327 Study of Hydrogen Embrittlement of UNS S32750 Pre-Strained Samples with IN-SITU X-ray Diffraction

ONLINE

Mauricio De Castro¹, Ana Luísa Terasawa Senra¹, Leticia Falcão Starck¹, Marcel Tadashi Izumi¹, Milene Yumi Maeda¹, Pedro da Silva Craidy², Ricardo Samson Namur¹, Osvaldo Mitsuyuki Cintho¹
¹State University of Ponta Grossa, Brazil ²Petrobras, Brazil

12 Advanced Automotive Steels (ASIC)

12-0594 Effects of Microstructure on Stretch Flangeability of 780 MPa Grade Cold-rolled Ultra High Strength Steel Sheets

ONLINE

Musheng Qiu
Shougang Group Co., Ltd., China

12-0721 Effect of Annealing Time on Microstructure and Properties of DP980 Steel

ONLINE

Ying Zou, Hua-sai Liu, Yun Han, Mu-sheng Qiu, Feng Yang
Shougang Research Institute of Technology, China

12-0735 Cube + Goss Textured Electrical Steels

Hyunwoo Mun
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12-1287 Bake Hardening of Intercritically Annealed 7Mn-3Al-0.2C Steel

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12-1312 Three-Dimensional Observation of the Upper Bainite Nucleated from Grain Boundaries in
④⑤ ONLINE Medium Carbon Steel

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12-1351 Dynamic Strain Aging during Warm Forming and its Contribution to Novel Strengthening
Mechanism in High Strength and Corrosion-resistant Fe–Mn–Al–C–Cr Steel

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Author Index

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
A					
Alfenas Moreira, Denise	01-0492	19	Bhuyan, Debabrata	04-0848	23
Ali, Sahin	03-0333	32		12-0689	38
	03-0336	36	Bi, Chuanguang	01-1216	27
	03-0343	31	Biro, Elliot	06-0274	47
Amano, Shota	03-0505	31		06-0941	48
An, Taekyu	04-1368	23	Bok, Jinbi	01-0443	27
Anaman, Sam Yaw	06-1018	49	Bong, Hyuk Jong	05-0371	21
Anand, Rajesh	01-1389	18		09-1375	25
Asaoka, Junya	05-0255	35	Bruel, Guillaume	01-0492	19
Ayyandurai, Ammasi	01-0438	27	C		
	03-0437	31	C, Srishilan	01-0428	27
B			Cai, Ning	06-0745	49
Bachmann, Florian	07-1071	20	Cao, Miao	04-1273	24
Back, Young-Gon	06-0691	50	Cao, Z.H.	12-0159	39
Bae, Gyuyeol	06-1248	48	Castro, Mauricio de	11-1274	63
	12-1262	53		11-1278	63
Bae, Hongyeol	06-0641	50	Cha, Kwangseo	02-1068	29
Bae, Hyo Ju	05-0484	34	Cha, Woo-Yeol	03-0533	46
	07-0623	60	Chae, Minseok	08-1059	36
Bae, Jae Wung	09-0843	25	Chai, Zhisong	12-0469	54
Baek, Un Bong	11-1168	62	Chakraborty, Sambhunath	03-1317	58
	11-1195	39	Chao, Yuelin	12-0294	55
Baik, Sung-Il	06-1018	49	Chaubey, Anil	01-1347	19
Bale, Hrishikesh	07-0637	21	Chen, Hao	12-0382	52
Baral, Madhav	09-0380	24	Chen, Jia-Jun	07-1090	61
Barlat, Frederic	09-0348	25	Chen, Shaoguo	01-0650	56
	09-0999	25		01-0740	27
Barnett, Roger	07-0320	20	Chen, Shuai-Feng	04-0858	23
Bartolomeo, Pedro	01-0492	19	Chen, Tingshu	11-0668	41
Beauchesne, Dennis	05-0346	32	Chen, Wei	03-0936	36
Bhattacharya, Rahul	03-0185	47	Cheng, Ming	04-0858	23
Bhoi, Bhagyadhar	01-1347	19	Cheng, Ming Yi	07-1140	61
			Cheng, Yujie	03-0927	45
			Chiba, Takahiro	11-0668	41

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
Chiu, Po Han	07-1154	61	Choi, Sangwoo	12-0695	55
Chiwandika, Edson Kugara	01-0443	27	Choi, Seonghwan	09-0911	24
Cho, Gue Serb	07-0570	60	Choi, Seunggyu	05-0573	58
Cho, Hoon-Hwe	06-1018	49	Choi, Shi-Hoon	04-1049	24
Cho, Hyung-Jun	11-0487	41		06-1038	48
	11-1284	63		09-1048	25
Cho, Jaeyoung	05-0496	34	Choi, Yeon Taek	09-0843	25
Cho, Jinhyung	03-1244	46	Choudhury, Gautam	03-0343	31
Cho, Jung-Wook	03-0417	57	Choudhury, Gautam Kr	03-0333	32
	03-0525	42		03-0336	36
	08-0671	52	Chowdary, Chava Venkata Appaiah	03-0343	31
Cho, Kyung-Chul	08-0457	37	Chu, Rensheng	03-0677	31
Cho, Min-Young	01-0279	19	Chun, Jinhyun	01-0873	29
Cho, Nu-Ri	11-1150	40	Chung, Byung Jun	01-0983	18
Cho, Seongkyu	01-0193	29	Chung, Byung-Jun	01-0193	29
	01-0744	28	Chung, Jea Sook	04-1306	23
Cho, Woojin	05-0603	34	Chung, Jeasook	04-1368	23
	09-0228	26	Chung, Jun Ho	05-0719	33
Cho, Yeonggeun	05-0609	34	Chung, Jun-Ho	05-0849	33
Cho, Yong Seok	04-1306	23	Chung, Junho	11-1165	40
Cho, Yong-Min	03-0533	46	Chung, Yongsug	03-1031	57
Cho, Yongkyun	10-1412	51		03-1035	57
Cho, Youngseok	04-1368	23		03-1043	57
Cho, Youngtae	06-1356	60		03-1065	57
Choi, Byeong-Chan	06-1200	60	Chung, Yongsug	03-1084	57
Choi, Duyoul	06-1248	48	Cintho, Osvaldo Mitsuyuki	11-0154	40
Choi, Hongjin	09-0911	24		11-1274	63
Choi, Hyoung Keun	08-0763	38		11-1278	63
Choi, Jihyeok	04-1342	58		11-1327	63
Choi, Jong Kyo	03-1208	42	Coetsee, Theresa	06-0460	50
Choi, Jongwon	09-0475	25	Cotton, Liam	01-0492	19
Choi, Joon Sung	03-0495	46	Craidy, Pedro da Silva	11-1274	63
Choi, Ju Hee	01-1091	29		11-1278	63
Choi, Ju-Hee	01-1087	28		11-1327	63
Choi, Kang Hyun	12-0830	38	Cui, Yuanyuan	01-0740	27
Choi, Moo Eob	02-0617	30			
Choi, Moo-Eob	02-1055	56			
Choi, Mooeob	01-0885	29			
Choi, Pyuck-Pa	06-0769	49			

D

Das, Hrishikesh	06-1018	49
Dasu, AVR Prabhakar	01-1389	18

AUTHOR	PAPER	PAGE
	01-1393	56
De Castro, Mauricio	11-1327	63
Demura, Masahiko	08-0974	36
Do, Hyeong Hyeop	12-0627	55
Dong, Wen-Liang	03-0854	57
Dong, Xianchun	06-0745	49
Dong, Zhihua	03-0741	44
Duan, Shengchao	03-0720	45
Dutta, Monojit	10-0211	51

E

Egashira, Yoshiyuki	03-1004	45
Endo, Rie	03-0879	43
Endoh, Takahiko	03-0607	43
Enoki, Manabu	08-0275	37

F

Ferrara, Lucas	01-0492	19
Findley, K. O.	05-0849	33
Findley, Kip	05-0346	32
Firsbach, Felix	01-0492	19
Fujii, Hidetoshi	06-0769	49
Fujimoto, Daiki	02-1359	56
Fukaya, Hiroshi	03-0509	45
Furuhara, Tadashi	05-0255	35
	07-0806	20
	12-0753	54
	12-0811	54
Furumai, Kohei	03-0470	44
	03-0473	42
Furuya, Hiroki	06-0349	50

G

G, Kalaivani	03-0454	47
Gachchi, Rajagopal	01-1389	18
Gamutan, Jonah	03-0509	45
Ganesh, Kalaivani	03-1271	58
Gao, Julei	03-0927	45

AUTHOR	PAPER	PAGE
Gao, Pan	03-0180	31
Gao, Yunming	03-0528	31
Ghosh, Sumit	05-0698	33
Gokhale, Amol A.	05-0698	33
Golani, Ravi	03-1192	32
Gong, Ho Young	06-0742	48
Gorain, Nemai	12-0341	52
Graham, Shaun David	07-1071	20
Gu, Guiyoung	12-1227	53
Gupta, Prakash	03-0185	47
Gwon, Hojun	05-0609	34
	05-0684	58
	05-0710	33

H

Ha, Chang-Su	03-1361	58
Ha, Man-Jin	08-0512	52
Han, Dokyeong	06-1248	48
Han, Heung Nam	05-0225	35
	05-0371	21
	05-0562	21
	05-0603	34
	07-0570	60
	08-0234	52
	08-0671	52
	09-0228	26
	10-0620	51
	12-0863	53
Han, Jeong-Whan	03-1361	58
Han, Jeongho	05-0573	58
	05-0575	58
	06-0769	49
	11-0630	62
	10-0503	62
Han, Min Soo	12-0872	54
Han, Sang-Ho	12-0627	55
Han, Seong Kyung	12-0758	54
	08-0457	37
Han, Woong-Hee	10-0567	51
Han, Yun		

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
	12-0171	38	Hong, Sungwon	12-1308	39
	12-0721	63	Hou, Zewang	03-0176	45
Hao, Chunxi	11-0154	40	Hu, Bin	05-0778	32
Harada, Tomoki	12-0753	54	Huang, M.X.	12-0159	39
Harpanahalli, Maheshbabu	03-0185	47	Huh, Seonguk	03-1148	42
Hassan, Ghassemi Armaki	06-0941	48		03-1187	43
Hayashi, Miyuki	03-0879	43	Hur, Seung Min	04-0222	35
He, Zhu	03-0528	31	Hwang, Byoungchul	05-0703	59
Heo, Hyeongmin	11-1168	62		05-0783	33
	11-1195	39		11-0685	62
Heo, Yoon Uk	07-0693	61	Hwang, Hyerim	05-0225	35
Heo, Yoon-Uk	03-0980	43	Hwang, InJun	03-1031	57
	03-1148	42	Hwang, Kyo Jun	08-0671	52
	03-1187	43	Hyun, Ju-Sik	11-1212	41
	03-1208	42	Hyun, Yong Min	05-0826	32
	05-0979	22			
	07-0652	61			
	07-0734	20	I, Mohammed Rasul	03-0454	47
	12-0725	39	Ikeda, Kohei	07-0806	20
Hirai, Azuma	01-0289	28	Ilie, Sergiu	03-0993	47
Hojo, Tomohiko	11-0154	40	Im, Young-Roc	12-1255	53
Holwell, Andy	07-0320	20	Iqbal, Mohammed Rasul	04-0683	24
	07-0637	21	Ishtiaq, Muhammad	07-0623	60
Hong, Dae-Geun	08-0457	37	Ito, Atsushi	12-0892	54
	08-0671	52	Ivlev, Sergey	01-0304	28
Hong, Hyun Uk	05-0719	33	Izumi, Marcel Tadashi	11-1274	63
	06-1367	60		11-1278	63
Hong, Hyun-Uk	07-1373	61		11-1327	63
	12-0708	55			
	12-1351	64			
Hong, Hyunuk	06-1356	60			
Hong, Jin-Sung	05-1010	22	Jang, Gwangjoo	06-0987	59
Hong, Seok-Hwan	12-1227	53		06-1158	60
Hong, Seok-Hyun	06-0808	49	Jang, Jae Hoon	05-0849	33
Hong, Seung Hyun	05-0371	21		12-0708	55
Hong, Seunggho	05-0836	21	Jang, Jae-il	07-0969	19
Hong, Sung-In	02-1068	29		12-0627	55
Hong, Sung-Tae	05-0562	21	Jang, Jaehoon	05-0225	35
	06-1018	49	Jang Min-Ho	06-0847	49

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
Jang, Myeong Hyeon	05-1269	59	Jun, Hyun Uk	06-1210	48
Jayaraj, Soorya Prakash	03-0454	47	Jung, Hwan Gyo	08-0568	38
	03-1271	58	Jung, Hwangyo	08-1264	37
	04-0683	24	Jung, Hyun-Yeong	11-1212	41
Jeon, Jin Myoung	08-0671	52	Jung, Im Doo	07-0709	20
Jeon, Jin-myoung	03-0417	57	Jung, In-Ho	08-1332	37
Jeon, Jong Jin	05-0710	33	Jung, Jaimyun	08-0568	38
Jeon, Seungwon	03-1035	57	Jung, Jinwook	05-0603	34
Jeong, Byeong-Seok	05-0603	34		08-0234	52
	09-0228	26		09-0228	26
Jeong, Chang Gon	07-0693	61	Jung, Seung Jin	06-0691	50
Jeong, Hyun-Bin	05-1010	22	Jung, Seung-Pill	11-1178	40
Jeong, Jae Seok	05-0484	34		11-1212	41
Jeong, Ji-Yeon	03-1208	42	Jung, Sung-Mo	01-0193	29
Jeong, Kyeongjae	05-0562	21		01-0744	28
	08-0234	52	Jung, Sung-Suk	03-0361	42
	12-0863	53	Jung, Sungmo	01-0443	27
Jeong, Mun Sik	05-0573	58			
	06-0769	49	K		
Jeong, Taesu	03-1244	46	K P, Elango	03-0296	31
Ji, Changwook	06-1210	48	K, Krishnakumar	03-0296	31
Ji, Chenzi	03-0315	43	K, Mariappan	05-0155	21
Jiang, Guangrui	10-0567	51	Kajikawa, Koji	03-0509	45
Jiang, Min	03-0176	45	Kamiya, Hiroki	05-0255	35
Jiang, Xianggui	03-0932	46	Kang, Haeun	10-1362	62
Jiang, Yuyang	01-0259	18	Kang, Jee-Hyun	06-0808	49
Jiao, Zengbao	05-0920	22		11-1284	63
Jie, Zhang	07-0890	20		12-1287	63
Jimbo, Shotaro	12-1312	64	Kang, Joo-Hee	04-1049	24
Jin, Sung-Woo	05-0562	21		07-0570	60
Jin, Woosung	06-0353	49	Kang, Jun-Yun	07-0570	60
Jo, Eun San	03-1175	57	Kang, Juseok	08-1264	37
Jo, Gyujin	05-0694	34	Kang, Kicheol	10-1412	51
Jo, Heonghye	04-1342	58	Kang, Minseok	06-0641	50
Jo, Hyo-Haeng	05-0849	33	Kang, Moonseok	05-1143	59
Jo, Jang Woong	11-0435	40		06-0987	59
Jo, Seung Jae	08-0867	38		06-1158	60
Jo, Youngwook	06-0812	50	Kang, Myeong Hun	03-1208	42
Johnson, William	01-0492	19	Kang, Namhyun	11-0959	39

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
	11-1033	40		12-1351	64
	11-1069	40	Kim, Do-Hyung	02-1055	56
	11-1165	40	Kim, Dong Woon	03-1382	58
Kang, Seok-Hyeon	05-1010	22	Kim, Dong-Hyun	03-0514	45
	12-0627	55		03-0548	57
Kang, Soo-Chang	03-1187	43	Kim, Dong-Ik	04-1049	24
	09-0911	24		10-0620	51
Kang, Xiaomin	03-0927	45	Kim, Dongha	05-1291	22
Kang, Youn-Bae	02-1055	56	Kim, Donghwi	08-1028	37
	03-0514	45	Kim, Dongjoon	04-0841	35
	03-0533	46	Kim, Dongmin	06-1356	60
	03-0548	57	Kim, Doo Young	06-0742	48
	03-0599	43	Kim, Doyub	06-0808	49
	03-0616	46		10-1412	51
Kang, Youngjo	01-1279	56	Kim, Eun-Young	12-1227	53
	03-0949	45		12-1255	53
Kano, Manabu	08-0358	37	Kim, Gaeon	01-0244	28
Katsube, Ryoji	03-0418	44	Kim, Han Gyeol	02-1354	56
Kaushik, Lalit	04-1049	24	Kim, Hansoo	08-1207	62
	06-1038	48	Kim, Ho Seung	03-0949	45
	09-1048	25	Kim, Hungsup	01-0635	19
Kawamoto, Yuuzoh	05-0481	32	Kim, Hwigeon	09-0475	25
Kawamoto, Yuzo	05-0477	34	Kim, Hye Jin	12-0627	55
Kawamura, Shinya	05-0477	34	Kim, Hye-Jin	11-0630	62
Kawanishi, Sakiko	03-0607	43		11-1212	41
Kawashiri, Yuki	01-0212	18	Kim, Hyeju	03-1148	42
Khullar, Akshay	03-0185	47		03-1187	43
Kikuchi, Naoki	03-0165	30	Kim, Hyeonjung	08-1267	37
	03-0505	31	Kim, Hyoshin	08-1264	37
Kim, Byong Chul	01-1279	56	Kim, Hyoung Seop	08-0568	38
Kim, Byongchul	01-0244	28		08-0671	52
Kim, Byoung-Koo	06-1200	60		09-0843	25
Kim, Byoungkoo	06-0987	59	Kim, Hyoung-Chan	06-1158	60
Kim, Byung Jun	05-1143	59		06-1200	60
	06-0987	59	Kim, Hyun-Soo	01-0279	19
	06-1158	60	Kim, Hyungil	10-1362	62
Kim, Byung-Jun	06-1200	60	Kim, In Chan	06-0691	50
Kim, Byungil	01-0635	19	Kim, Jae Dong	01-0768	28
Kim, Chiwon	12-0708	55	Kim, Jae Nam	11-0435	40

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
Kim, Jae-yoon	08-0867	38	Kim, Sun Joong	01-1091	29
Kim, Jeongin	01-0289	28		03-1173	47
Kim, Jewoosoo	12-0627	55	Kim, Sun-Joong	03-0894	46
Kim, Ji-Hoon	12-1227	53		03-1175	57
Kim, Jin You	08-0568	38	Kim, Sung Jin	11-1178	40
Kim, Jin-Hwan	09-0348	25	Kim, Sung-Dae	05-0849	33
Kim, Jin-Kyung	05-0821	59	Kim, Sung-Ho	05-0684	58
Kim, Jin-Young	06-1079	60		05-0710	33
Kim, Jinkyung	05-0747	59	Kim, Sung-Il	05-0603	34
	05-0750	59		09-0228	26
Kim, Jinyoung	05-0747	59	Kim, Sung-Joon	05-0609	34
Kim, Jiwoong	06-0353	49		05-0684	58
Kim, Jong Wan	03-0980	43		05-0710	33
	05-0979	22		06-0808	49
Kim, Jongwoo	04-1342	58		11-0487	41
Kim, Jung Gi	05-0484	34		12-1287	63
	07-0623	60	Kim, Sung-Wan	01-0744	28
	07-0709	20	Kim, Sungjoo	10-1404	51
Kim, Jungkyu	08-0591	52	Kim, Sunjoong	01-1087	28
Kim, Junyong	01-0244	28	Kim, Tae Hoon	06-1367	60
Kim, Kyeong-Won	12-0863	53	Kim, Tae Sung	03-1230	36
Kim, Kyu-Sik	05-1076	59		03-1382	58
	06-1079	60	Kim, Tae Yeong	05-0719	33
Kim, Kyung Il	07-0570	60		06-1367	60
Kim, Kyung Young	06-0742	48	Kim, Tae-Ha	12-0863	53
Kim, Kyutae	05-0836	21	Kim, Tae-Hun	07-1373	61
Kim, Min Geol	03-1148	42	Kim, Tae-Yeong	07-1373	61
Kim, Minjeong	11-0954	41	Kim, Taehyeon	01-1403	56
Kim, Moon-Jo	05-0562	21	Kim, Taesung	03-1244	46
Kim, Nack J.	12-0882	52	Kim, Wan-Yi	03-0616	46
Kim, Nack Joon	12-0943	38		03-0989	46
Kim, Sang-Gyu	11-0685	62	Kim, Woo-Gon	07-1373	61
Kim, Sang-Heon	12-0872	54	Kim, Woo-Jin	06-0847	49
Kim, Sangbin	01-0885	29	Kim, Yang Do	06-1200	60
Kim, Sangho	05-0496	34	Kim, Yanghoo	05-0225	35
Kim, Seong Ju	12-0627	55	Kim, Yong Woo	03-0894	46
Kim, Seong-yeon	03-0361	42	Kim, Yongju	08-0568	38
Kim, Seongbeum	03-0525	42	Kim, Yongwoo	08-1028	37
Kim, Seongwoo	12-0872	54	Kim, Youngjun	06-0812	50

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
Kim, Youngwoo	05-0836	21	Lai, Qingquan	12-0469	54
Kishimoto, Yasuo	03-0165	30	Lai, Yu Wei	07-1154	61
Kita, Takuya	05-0255	35	Lalachan, Arun	06-0353	49
Klemm-Toole, Jonah	05-0346	32		06-0742	48
Ko, Kwang Kyu	05-0484	34	Lauridsen, Erik	07-1071	20
	07-0623	60	Lazuardi, Dimas Reza	12-1287	63
Ko, Yoon Seok	10-0620	51	Lee, Bong Ho	05-0849	33
Koo, Minseo	12-1227	53		12-0708	55
Koo, Yong-Mo	06-1079	60	Lee, Chang Hoon	05-0719	33
Korkolis, Yannis	09-0380	24		06-1367	60
Koyama, Motomichi	11-0154	40	Lee, Chang-Hoon	05-0849	33
	11-0668	41		06-0691	50
Kumar, Adiraju Kranthi	03-0241	30		12-0708	55
Kumar, Ashutosh	03-1192	32		12-1351	64
Kumar, Deepak	03-0333	32	Lee, Chang-Yong	06-0847	49
Kumar, Gaurav	05-0698	33	Lee, Changhoon	11-1165	40
Kumar, Manish	03-0333	32	Lee, Changyong	06-0353	49
	03-0343	31	Lee, Chong Soo	11-0435	40
Kumar, Shiva	01-1389	18	Lee, Dongsoo	01-0244	28
	01-1393	56	Lee, Dongwon	07-0652	61
Kumar, TV. Vijaya	01-1197	28	Lee, Haeung	01-0873	29
Kumar, Ujjwal	03-0333	32	Lee, Hak Hyeon	09-0843	25
Kumar, Vishnu Manish	03-0336	36	Lee, Han Ju	06-0742	48
Kumari, Ajita	01-1197	28	Lee, Hye Ran	01-1279	56
Kuwabara, Toshihiko	09-0375	25	Lee, Hyeong-Yeon	07-1373	61
Kwon, Dongil	08-0234	52	Lee, Hyongjun	12-1308	39
Kwon, Gi Woong	01-0997	18	Lee, Hyoung-Jun	03-0361	42
Kwon, Hyeonseok	09-0843	25	Lee, Hyukjae	08-0234	52
Kwon, Hyuckcheol	04-1368	23	Lee, Hyun Wook	05-0575	58
Kwon, Minhyeok	10-1412	51	Lee, Jae Sang	03-0980	43
Kwon, Oh Min	08-0234	52		03-1148	42
Kwon, Sang-Hum	03-1148	42		03-1187	43
	03-1187	43		03-1208	42
	08-0457	37		05-0979	22
Kwon, Young Jin	05-0694	34		07-0652	61
Kwon, Yung Kug	12-1052	53		12-1255	53
			Lee, Jae-Seung	05-1076	59
			Lee, Jaewook	09-1007	25
			Lee, Je-Shin	02-1068	29
L					
La, Joung-Hyun	06-0847	49			

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
Lee, Jia	03-1361	58	Lee, Seil	05-0684	58
Lee, Jinhwan	04-0841	35	Lee, Seok-Jae	05-0573	58
Lee, Jinwoo	09-1375	25	Lee, Seung-Joon	06-0769	49
Lee, Jong-Sook	06-1018	49	Lee, Seungchul	04-1368	23
Lee, Jonghyup	01-0244	28	Lee, Seungjin	04-0886	35
Lee, Jongwhan	04-1368	23	Lee, Seungmin	12-1308	39
Lee, Joo Dong	03-1208	42	Lee, Seungwook	03-1065	57
Lee, Joo-Hyeok	03-0599	43	Lee, Shin-Yeong	09-0348	25
Lee, Joonho	01-0873	29	Lee, Sooyeon	03-1208	42
	01-1182	29	Lee, Sungho	07-0654	21
	05-0783	33	Lee, Wonbae	06-1356	60
	08-1207	62	Lee, Young Seon	07-0693	61
Lee, Jung-Uk	05-1076	59	Lee, Young Su	05-0719	33
Lee, Junghoon	11-0959	39	Lee, Young-Ju	12-1351	64
	11-1033	40	Lee, Young-Kook	05-1010	22
Lee, Junmo	11-0435	40		05-1291	22
Lee, Kang Won	08-0763	38		11-0773	39
Lee, Kee-Ahn	05-1076	59		11-0954	41
	06-1079	60		11-1150	40
Lee, Ki Woo	01-1091	29		11-1195	39
Lee, Ki-Woo	01-1087	28	Lee, Youngseog	04-0841	35
Lee, Min-Joo	03-0720	45	Lee, Yubin	01-0244	28
Lee, Mokyoung	06-1248	48	Lee, Yun Mo	01-1279	56
Lee, Myoung-Gyu	05-0371	21	Lelong, Vincent	05-0346	32
	05-0783	33	Li, Baokuan	03-1034	31
	05-0922	22	Li, Dayong	09-0456	24
	09-0228	26	Li, Guangqiang	03-0528	31
	09-0911	24		03-1034	31
	11-1212	41	Li, Tiejun	10-0567	51
Lee, Sang Joon	06-1200	60	Li, Weidong	05-0659	21
Lee, Sang-Beom	03-1230	36	Li, Yan	10-0567	51
Lee, Sang-In	05-0703	59	Li, Yawei	03-0528	31
Lee, Sang-wook	12-0758	54	Liang, Ce	03-0249	42
Lee, Sanghyeon	08-0833	62	Lim, Young-Min	06-0847	49
Lee, Sanghyung	02-1068	29	Lima, Michel	01-0492	19
Lee, Sanghyup	05-0836	21	Lin, Wang	04-0663	23
Lee, Sangjin	04-0841	35	Ling, Jiawei	01-0259	18
	08-0833	62	Listyawan, Timothy	05-1269	59
Lee, Seawoong	12-0872	54	Liu, Banjemen Pei-Herng	07-1097	61

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
Liu, Dekun	03-0448	43	Mi, Zhenli	03-0741	44
Liu, Hua-sai	12-0721	63	Michelic, Susanne	03-0993	47
Liu, Ke	03-0315	43	Midawi, Abdelbaset R.H.	06-0941	48
Liu, Stephen	11-0959	39	Miki, Takahiro	03-0509	45
Liu, Yu	03-1034	31	Min, Dong Joon	03-0495	46
Lu, Liming	01-0307	27	Min, Hyeongwoo	04-1342	58
Lu, Qi	12-0469	54		10-1362	62
Lu, Shih Yuan	07-1097	61	Min, Kyung Mun	05-0371	21
Luo, Zhijun	05-0219	21		05-0922	22
Lv, Naibing	05-0219	21	Mishra, Sushil K	05-0698	33
Lv, Xuwei	01-0259	18	Misra, Siddhartha	03-0241	30
Lyu, Ahjeong	11-0954	41	Miyamoto, Goro	05-0255	35
Lyu, Naibing	03-0146	47		07-0806	20
				12-0753	54
				12-0811	54
				10-0211	51
M, Vimal	03-0296	31	Mondal, Kallol	11-1069	40
Ma, Guangyu	05-0659	21	Moon, Byungrok	11-1165	40
Ma, Huaiying	01-0650	56		09-0911	24
Ma, Yue	05-0270	34	Moon, Chanmi	04-0841	35
Maeda, Milene Yumi	11-0154	40	Moon, Hongkil	08-0833	62
	11-1274	63		05-1143	59
	11-1278	63	Moon, Hyoung-Seok	06-1200	60
	11-1327	63		05-0719	33
Maeda, Takuya	05-0477	34	Moon, Joon Oh	05-0849	33
	05-0481	32	Moon, Joonoh	06-0691	50
Mahanta, Suchit	03-0333	32		06-1367	60
Maheshbabu, Harpanahalli	03-0241	30		12-0708	55
Manna, R.	12-0689	38		12-0863	53
Manna, Rampada	04-0848	23		04-0381	35
Mao, Xinping	03-0741	44	Morikawa, Yuta	01-0212	18
Masumura, Takuro	05-0477	34	Morita, Yuya	03-0741	44
	05-0481	32	Mu, Wangzhong	03-0333	32
	05-0840	22	Mukherjee, Manishankar	12-0735	63
Matsui, Akitoshi	03-0165	30	Mun, Hyunwoo	06-0353	49
Matsuura, Hiroyuki	02-1359	56	Murugan, Siva Prasad	06-0691	50
Mazumdar, Dipak	01-1149	18		06-0742	48
	03-0151	44	Murugan, Sivaprasad	01-0304	28
	03-1202	44	Murzin, Yuri	03-1043	57
Meng, Fanshuang	01-0655	28	Myung, Jaewoo		

AUTHOR	PAPER	PAGE
--------	-------	------

N

Na, Hyuntaek	05-0603	34
	09-0228	26
Na, Jihoon	08-1267	37
Na, Jisu	10-1362	62
Na, Mi Ran	03-1173	47
Na, Min Sik	01-0997	18
Na, Seon Hyeong	12-0758	54
Nagai, Shinji	04-0381	35
Nagarajan, Mohanraj	01-1389	18
	01-1393	56
Nagata, Hiroshi	03-0336	36
	03-0343	31
Nakai, Yoshie	03-0165	30
	03-0505	31
Nakajima, Seika	03-0509	45
Nakashima, Kunihiro	03-1004	45
Nallusamy, Vasumathi	01-1197	28
Nam, Jae-Hoon	11-0954	41
	11-1150	40
Nam, Jimin	11-1069	40
	11-1165	40
Nambu, Shoichi	12-1312	64
Namur, Ricardo Samson	11-1327	63
Namur, Ricardo Sanson	11-1274	63
	11-1278	63
Nanri, Yukihiro	03-0418	44
Naofumi, Kido	03-0343	31
Narumi, Taka	03-0418	44
Natsui, Shungo	01-0289	28
Nellikode, Savyasachi	06-0691	50
Ningshen, S	05-0155	21
Nishi, Tsuyoshi	03-0607	43
Nispel, Michael	01-0492	19
Nogami, Hiroshi	01-0289	28
Noh, Han-Seop	08-0512	52
Nouchi, Taihei	01-0212	18
Nurni, Viswanathan N	03-1271	58

AUTHOR	PAPER	PAGE
--------	-------	------

O

Oddershede, Jette	07-0637	21
Oh, Dong-Kyu	05-0703	59
Oh, Han Sang	01-1279	56
Oh, Hansang	01-0244	28
Oh, Jinkeun	12-0872	54
	12-0943	38
Oh, Kijang	08-1207	62
	07-0570	60
Oh, Kyu Hwan	07-0570	60
Oh, Yeonju	07-0570	60
Ohmura, Takahito	07-0351	20
Ohta, Hiromichi	03-0607	43
Omura, Shun	06-0349	50
Ozawa, Sumito	01-0212	18

P

P.V.S, Nikhil	01-1347	19
Paek, Min-Kyu	03-0894	46
Pal, Jagannath	01-0438	27
Pallasपुर, Sakari	05-0698	33
Palli, Abhishek	01-1197	28
Pan, Wen	01-0650	56
	01-0740	27
Pan, Xiaoqian	03-0448	43
	03-0333	32
Pandey, Gaurav	03-0343	31
Pandey, R. K.	12-0689	38
	03-0241	30
Pang, Zhengde	01-0259	18
Park, Beomshin	03-1031	57
Park, Bong June	12-0758	54
Park, Cheolho	11-0959	39
Park, Eunhye	07-0623	60
Park, Geon-Woo	05-1143	59
Park, Gyeongbae	12-0882	52
Park, GyungBae	12-0943	38
Park, Hanji	11-0959	39
Park, Hyeonwoo	01-0873	29

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
	01-1182	29		09-0228	26
	08-1207	62	Park, Taechang	07-0654	21
Park, Hyoungkuk	10-0682	51	Park, Tak Min	05-0573	58
Park, Hyung Keun	08-0568	38		05-0575	58
Park, Jaeyeong	11-1168	62		11-0630	62
	11-1195	39	Park, Teajun	01-0244	28
Park, Jeong Min	09-0843	25	Park, Won-Bum	03-0514	45
Park, Jin Sung	11-1178	40	Park, Wonbum	02-1055	56
Park, Jinheung	05-0922	22	Park, Yeong- Do	06-0691	50
Park, Jiook	01-0885	29	Park, Yeong-Do	06-0742	48
Park, Jiun	06-1356	60	Park, Yeongdo	06-0353	49
Park, Jiwoo	01-0873	29	Park, Young-Joon	03-0616	46
Park, Jongin	01-0635	19	Park, Youngah	04-1342	58
Park, Joo Hyun	03-0741	44		10-1362	62
	03-1230	36	Park, Youngjoo	01-0244	28
	03-1382	58	Patil, Jeet	05-0698	33
Park, Joo-Hyun	03-0720	45	Pawar, Saurabh	06-1038	48
Park, Joohyun	03-1244	46	Penz, Alexander	03-0993	47
	03-1398	36	Phillion, Andre	03-0470	44
Park, Joonbeom	01-1182	29		03-0473	42
Park, Jun Young	12-0863	53	Pistorius, Chris	06-0460	50
Park, Jun-Yong	03-0361	42	Prabowo, Irfan Fawaz	11-1284	63
Park, Jung-Hyun	06-1079	60	Prokofiev, Boris	01-0304	28
Park, Junwoo	01-1182	29			
Park, Ki Seong	09-1048	25	Q		
Park, Ki-Seong	06-1038	48	Qiu, Mu-sheng	12-0721	63
Park, Kyong Su	12-1052	53	Qiu, Musheng	12-0594	63
Park, Kyung Tae	01-0635	19	Qiu, Suochao	01-0740	27
Park, Minha	05-1143	59			
	06-0987	59	R		
	06-1158	60	Rajput, Priyanka	01-1347	19
Park, Nokeun	05-1269	59	Raju, Raghavendra	03-1317	58
Park, Sang-Chae	03-0514	45	Ramachandran, Dileep	06-0941	48
Park, Sangeun	07-0709	20	Ranjan, Subham	01-1149	18
Park, Seong-Jun	07-0652	61	Rao, Srinivas	01-1389	18
	12-0708	55		01-1393	56
	12-0863	53	Ren, Qiang	03-0927	45
	12-1351	64		03-0932	46
Park, Siwook	05-0603	34			

AUTHOR	PAPER	PAGE
Ren, Ying	03-0928	44
	03-0932	46
Reyne, Baptiste	09-0999	25
Roessler, Roman	03-0993	47
Roh, Yonghoon	04-0841	35
Rout, Matruprasad	05-0922	22
Roy, Tapas Kumar	03-0185	47
	03-1192	32
Ryu, Geun Yong	01-1091	29
Ryu, Geun-Yong	01-1087	28

S

Sadeghi, Fazlollah	03-0980	43
	05-0979	22
Saha, Sourav Kr.	11-1069	40
	11-1165	40
Sai, Aakash Dasari	03-0336	36
Saito, Ken	03-0509	45
Saito, Noritaka	03-1004	45
Samanta, Santigopal	10-0211	51
Sambandam, Manjini	03-0454	47
	03-1271	58
	04-0683	24
Sanyal, Sarbendu	03-1317	58
Sastry, G.V.S	04-0848	23
Sato, Mitsutaka	12-0811	54
Sato, Yutaka	06-0349	50
Schmidt, Ute	07-0320	20
See, Seongkyu	04-0886	35
Senra, Ana Luísa Terasawa	11-1274	63
	11-1278	63
	11-1327	63
Seo, Hyun Joo	11-0435	40
Seo, Junghun	12-1308	39
Seo, Min Seok	02-0237	30
Seo, Seok Jong	12-1052	53
Seo, Yongki	07-0654	21
Seok, Chang Woo	03-0949	45
Seol, Jae Bok	05-0484	34

AUTHOR	PAPER	PAGE
	07-0623	60
	07-0709	20
Shao, Ningning	02-0187	29
Shao, Xiao-Jing	03-0854	57
Sharma, A.	12-0689	38
Shekhar, Shashank	03-1317	58
Shekhawat, V S	03-1192	32
Shibata, Akinobu	11-0668	41
Shibata, Hiroyuki	03-0607	43
Shibayama, Hiroshi	10-0169	50
Shim, Hyunbo	05-0836	21
Shim, Jae Hyeok	06-1038	48
Shim, Jae-Hyeok	05-0783	33
Shin, Chansun	05-0849	33
Shin, Dong-Jun	02-1068	29
Shin, Ji Young	06-0742	48
Shin, Jong-Ho	12-0863	53
Shin, Seung-Hyeok	11-0685	62
Shin, Yasuaki	03-0336	36
Shirahata, Hiroyuki	05-0477	34
	05-0481	32
Shiruo, Chen	03-0879	43
Shit, Gopinath	05-0155	21
Shukla, Ajay Kumar	01-0428	27
	03-0404	47
Singh, Abhishek Kumar	06-1038	48
Singh, J B	03-1317	58
Singh, Jaiveer	04-1049	24
Singh, Lokendraraj	01-1389	18
	01-1393	56
Singh, Naveen	01-1389	18
	01-1393	56
Singh, Raj Bahadur	04-0848	23
Singh, Saroj Kumar	03-0185	47
	03-0199	30
Singh, Shiv Brat	10-0211	51
Singh, Sudhanshu Shekhar	05-0155	21
Singha, Prasenjit	01-0428	27
	03-0404	47

AUTHOR	PAPER	PAGE
	05-0481	32
Uhm, Sangho	06-1248	48
Um, Ho Yong	11-0630	62
Uranaka, Shohei	05-0481	32
V		
Van Ende, Marie-Aline	08-1332	37
Vilela, Larissa	05-0346	32
Voonna, Suresh	01-1389	18
Voonna, Sureshraj	01-1393	56
W		
Wang, Chang	04-1027	23
Wang, Cong	06-0204	48
Wang, Fenghui	06-0745	49
Wang, J.F.	12-0159	39
Wang, Jianfeng	12-0469	54
Wang, Jujin	03-0928	44
Wang, Kun	05-0219	21
Wang, Kunpeng	03-0176	45
Wang, Qiang	03-0528	31
	03-1034	31
Wang, Quanli	12-0294	55
Wang, Wanlin	03-0249	42
Wang, Xiang	03-0470	44
Wang, Xinhua	03-0176	45
Wang, Ying	03-0176	45
Wang, Yong	03-0741	44
Wang, Yongjin	05-0778	32
Wang, Z.	12-0159	39
Wang, Zhanjun	02-0265	30
Watanabe, Takashi	03-0879	43
Wee, Changhyun	04-0841	35
	08-0833	62
Wi, Dong-Yeol	05-1076	59
Wi, Min-Su	09-0348	25
Woo, Kyoung Sik	04-0222	35
Wu, Lijun	01-1216	27

AUTHOR	PAPER	PAGE
X		
Xiong, Zhiping	12-1014	54
	12-1022	53
Xu, Longyun	03-0448	43
Xu, Shixin	05-0219	21
Xu, Wei	05-0659	21
	12-0469	54
Xu, Xiangbo	01-1216	27
Y		
Yadav, Sunil	01-0428	27
Yamasaki, Koichiro	07-0806	20
Yan, Zhiming	01-0259	18
Yanagimoto, Jun	05-0778	32
Yang, Dezhen	12-1014	54
Yang, Feng	12-0721	63
Yang, Hanna	11-1168	62
	11-1195	39
Yang, Jer Ren	07-1140	61
	07-1154	61
Yang, Jer-Ren	07-1090	61
	07-1094	61
	07-1097	61
	07-1378	19
Yang, Jian	03-0448	43
Yang, Wen	03-0932	46
Yang, Yanjing	07-1071	20
Yang, Yonggang	03-0741	44
Yasuda, Hideyuki	03-0418	44
Yeo, Sangrok	03-1084	57
Yeo, Tae-min	03-0417	57
Yi, Sang-Ho	01-0714	18
Yim, Chang Hee	03-0980	43
	03-1148	42
	03-1187	43
	03-1208	42
	05-0979	22
Yim, Chang-Hee	08-0457	37

AUTHOR	PAPER	PAGE	AUTHOR	PAPER	PAGE
Yoo, Byung-Gil	12-0627	55	Zhang, Yapeng	01-0650	56
Yoo, Chaeyeon	03-1043	57		01-0740	27
Yoo, Jaehong	06-0812	50	Zhang, Yinhui	03-0448	43
Yoo, Jang-Yong	05-0496	34	Zhang, Yongjie	07-0806	20
Yook, Wan	06-0847	49	Zhang, Zuotai	02-0187	29
Yoon, Cheol Min	03-0495	46	Zhao, Aihua	01-0655	28
Yoon, Eun Yoo	07-0693	61	Zhao, Shuai	05-0778	32
Yoon, Seong-Yong	09-0348	25	Zhao, Yingjian	06-0745	49
Yoon, Si-Kyung	01-0279	19	Zhao, Yu	05-0659	21
Yoon, Young-Chul	05-0703	59	Zhao, Zhixing	01-0650	56
Yoon, Youngsoo	04-1342	58	Zhou, Bingchen	05-0920	22
	10-1362	62	Zhou, Jie	05-0270	34
Yoshida, Hironori	03-0505	31		12-0294	55
You, Donggyun	05-0750	59	Zhou, Yuxiong	05-0840	22
You, Wonhyo	07-0654	21	Zou, Ying	12-0721	63
Yu, Wei	05-0219	21	Zurob, Hatem	03-0470	44
Yu, Yang	04-1027	23		03-0473	42
Yug, Wanee	06-0353	49			
Yukawa, Nobuki	04-0381	35			
Yun, Sangman	06-1248	48			

Z

Zargar, Tahereh	03-0980	43
	05-0979	22
Zargaran, Alireza	12-0882	52
	12-0943	38
Zhang, Chao	12-1022	53
Zhang, Hong-Yan	03-0854	57
Zhang, Jin	06-0204	48
Zhang, Lei	03-0249	42
Zhang, Lifeng	03-0927	45
	03-0928	44
	03-0932	46
	03-0936	36
Zhang, Qi	04-1273	24
Zhang, Shi-Hong	04-0858	23
Zhang, Tianfu	01-0655	28
	05-0659	21
Zhang, Yanyun	06-0204	48

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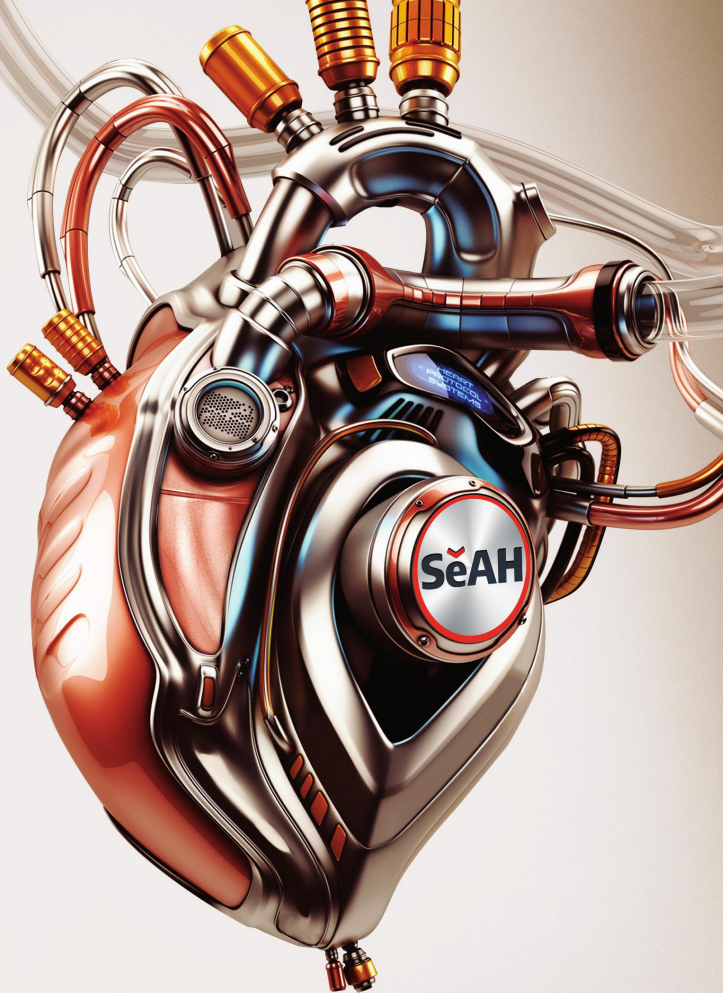
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STS, 공구강, Ni-Alloy 분야의 글로벌 리더로 도약하는 세아창원특수강
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