

Program
EMECCR
2017

Program

EMECCR 2017

1st International Conference on Energy and Material Efficiency
and CO₂ Reduction in the Steel Industry

Date Wed 11 – Fri 13, October, 2017

Venue Kobe International Conference Center,
Kobe, Japan
<http://kobe-cc.jp/english/index.html>

URL <http://www.emecr2017.com>



Organized by

The Iron and Steel Institute of Japan, ISIJ



Welcome Message

I would like to heartily welcome you to EMECR2017 that will be held in Kobe, Japan, in 2017 following on from the last fruitful meeting at ESEC2014 (European Steel Environment & Energy Congress), held in Teesside, UK, in 2014. The major themes of this conference will be energy efficiency and carbon dioxide (CO₂) reduction, and also materials efficiency and product life cycles in the steel industry.

The main dilemma facing the steel industry is to keep a balance between improving environmental performance and maintaining cost competitiveness.

There is also a need to ensure that the steel industry provides sustainable products which meet society's growing needs against a background of future resource constraints and the need to mitigate climate change. The steel industry is required to improve energy efficiency for meeting these climate change targets accompanied with CO₂ emission mitigation.

The improvement is one of the major contributors for reducing operational costs as well as improving environmental performance. The tool of Life Cycle Assessment (LCA) is being used to demonstrate the potential of steel. By considering the environmental performance of steel products with LCA analysis, recycling of steel products makes them highly competitive in sustainability terms.

These are the key challenges to be addressed by this conference. This conference will showcase innovation and technology, provide details of the latest industry solutions to energy and environmental issues, and will demonstrate how the steel industry is meeting the many challenges that it is currently facing.

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Takaiku Yamamoto, Prof. Dr.
Conference Chair
Kyoto University



Organizers/Committees

Organizers

Organized by

The Iron and Steel Institute of Japan, ISIJ

Co-organized by

The 54th Committees

Japan Society for the Promotion of Science

Supporting Organizations

FIST Foundation for Interaction in Science & Technology, Japan

The Japan World Exposition 1970 Commemorative Fund

Hyuga Memorial Grant for International Conference

Organizing Committee Members

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Conference Co-Chair

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NOGAMI, Hiroshi (Tohoku University)

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SUMI, Ikuhiro (JFE Steel Corporation)

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TANAKA, Toshihiro (Osaka University)

TUBONE, Akira (Aichi Steel Corporation)

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WAKIMOTO, Shinya (The Iron and Steel Institute of Japan)

YAMASUE, Eiji (Ritsumeikan University)

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BAJAY, Sergio Valdir (UNICAMP)

BIRAT, Jean-Pierre (IF Steelman)

BRIMACOMBE, Luis (Tata Steel)

ITO, Kimihisa (Waseda University)

KASAI, Eiki (Tohoku University)

LUENGEN, Hans Bodo (VDEh)

MATSUOKA, Saiji (JFE Steel Corp.)

MIYAKE, Toshiya (Kobe Steel, Ltd.)

MORITA, Kazuki (The University of Tokyo)

MURAKAMI, Hideki (Nippon Steel & Sumitomo Metal Corp.)

NOLDIN, Jose (Lhoist)

STEEPER, Mick (Primetals Technologies)

THACKRAY, Richard (The University of Sheffield)

TSUKIHASHI, Fumitaka (The University of Tokyo)

UENO, Hiromitsu (Nippon Steel & Sumitomo Metal Corp.)

YI, Sang-Ho (POSCO)

YIN, Ruiyu (Central Iron & Steel Research Institute)

Corporating Organizations

Architectural Institute of Japan

Associação Brasileira de Metalurgia, Materiais e Mineração (ABM), Brazil

Association for Iron and Steel Technology (AIST), USA

Associazione Italiana di Metallurgia (AIM), Italy

The Austrian Society for Metallurgy and Materials (ASMET), Austria

The Chemical Society of Japan

The Chinese Society for Metals (CSM), China

Czech Metallurgical Society, Czech Republic

French Steel Federation (FFA), France

Hungarian Mining and Metallurgical Society (OMBKE), Hungary

The Institute of Life Cycle Assessment, Japan

Japan Association of Corrosion Control

Japan Bridge Association

The Japan Institute of Metals and Materials

The Japan Iron and Steel Federation

The Japan Research and development Center for Metals

Japan Science and Technology Agency

Japan Society of Civil Engineers

The Japan Society of Mechanical Engineers (JSME)

Japanese Society of Steel Construction

The Mining and Materials Processing Institute of Japan

The Society of Chemical Engineers, Japan

Society of Environmental Science, Japan

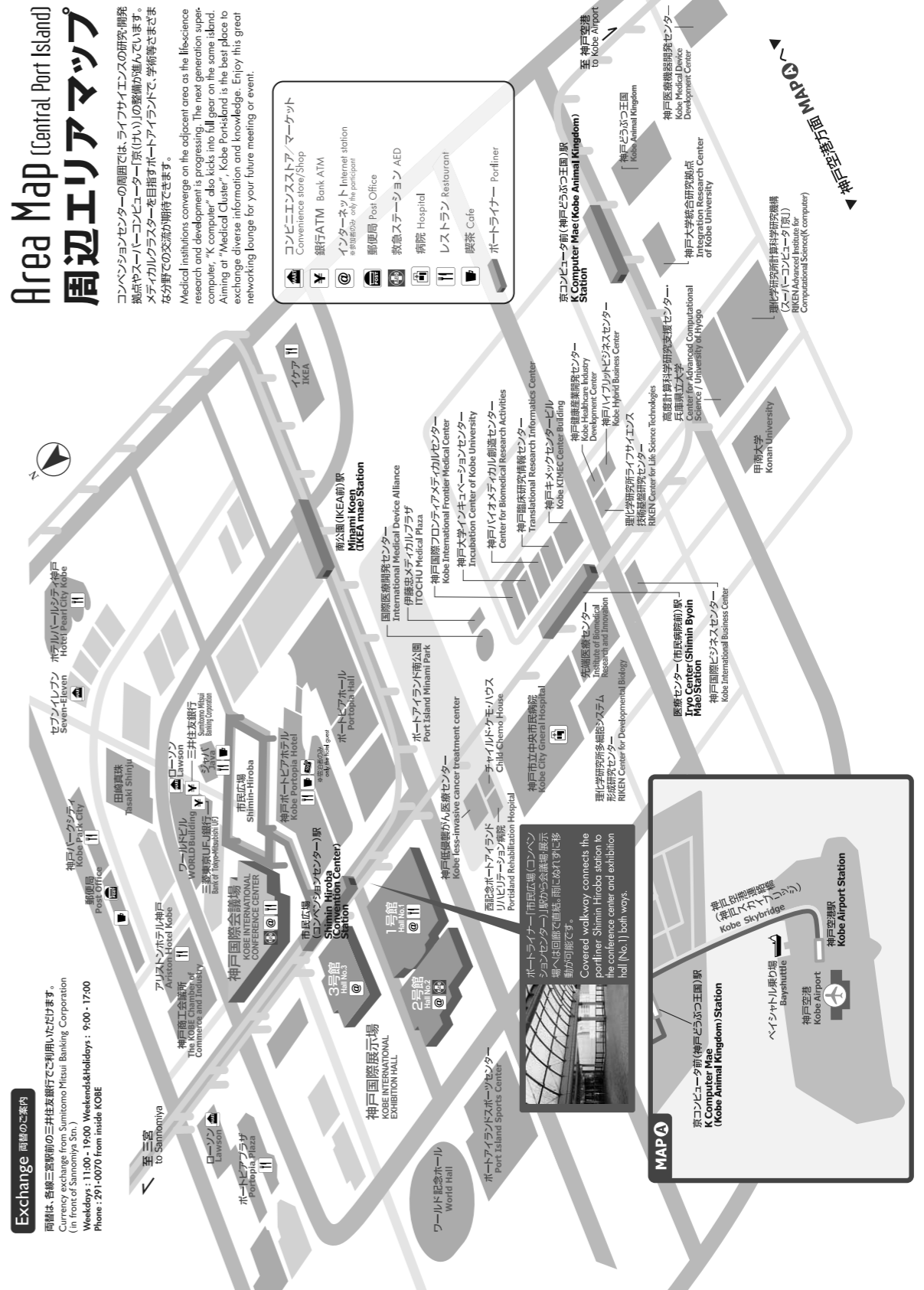
Steel Institute VDEh, Germany

The Swedish Steel Producers Association (Jernkontoret), Sweden

UNESID Steel Companies Association, Spain

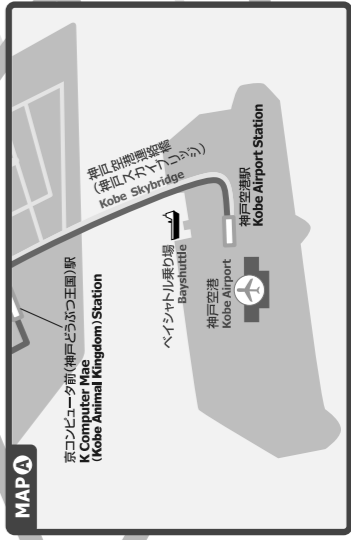
Access

Area Map (Central Port Island) 周辺エリアマップ



Exchange 両替のご案内
両替は、各線三塚駅前の子井友友銀行でご利用いただけます。
Currency exchange from Sumitomo Mitsui Banking Corporation
(in front of Samonoya Sta.)
Weekdays: 11:00 - 19:00 Weekends&Holidays: 9:00 - 17:00
Phone: 291-0070 from inside KOBE

ポートライナー (神戸三宮) 駅
Shimin Hiroba Station
Covered walkway connects the
portliner Shimin Hiroba station to
the conference center and exhibition
hall (No. 1) both ways.



General Information

Registration Desk

OPENING HOURS:

Wednesday, October 11 8:15-19:30
Thursday, October 12 8:30-19:00
Friday, October 13 8:30-13:00

Please make sure to wear your name badge during the conference.

Coffee Breaks and Meals

Beverages during the coffee breaks are included in the registration fee and will be available daily in the foyer near the registration desk.

Lunch will not be served. Please arrange your own lunch at the restaurants in the vicinity.

Welcome party will be held on Wednesday night at the Reception Hall. Banquet will be held on Thursday night at Portpia Hotel, which is adjoined to the conference venue.

Internet

Free WIFI service is available at the conference venue.

SSID: ConventionCenter

Password: EMECR2017

Passport and Visa

A valid passport is required to enter Japan. Participants from certain countries may be required to obtain a visa to enter Japan. Visa applications need to be made at least three months before the Conference. If you are uncertain about your requirements, please consult your nearest Japanese Embassy or Consulate, or visit the website of the Ministry of Foreign Affairs of Japan.

Climate and Clothing

During October, the average temperature in Kobe is around 16-23°C (60-73°F).

Currency

Only Japanese Yen is acceptable at regular store and restaurants. Foreign currency or traveler's checks can be changed into Japanese yen (¥) at major banks, hotels, and airports.

Credit Cards

Credit cards are widely accepted. Commonly recognized cards include Visa, MasterCard, and American Express.

Tipping

There is no custom of tipping anywhere in Japan, even at hotels and restaurants. On certain occasions, however, a service charge is added to the bill.

Electrical Appliances

The voltage in Japan is 100 - 110 volts for electrical appliances. Electrical sockets usually accept only two-pronged (vertical) plugs.

Banks and Post Office

Most banks open at 09:00 and close at 15:00, from Monday through Friday.

The nearest ATM is located in the WORLD BUILDING, from a 5-minute walk from the conference venue.

Foreign Exchange service is not available at the conference venue.

The nearest Post Office is located in Kobe Park City, a 5-minute walk from the conference venue.

Social Program

Social Events

Welcome Reception

Wednesday, October 11

All registered participants and their accompanying persons are invited to attend the Welcome Reception. A light meal and drinks will be served.

Banquet

Thursday, October 12

Venue: PORTOPIA HOTEL

All registered participants and their accompanying persons are invited to attend the Banquet.

Plant Tour

The plant tour in the afternoon of October 13th observes the Kobe Steel Works of Kobe Steel, LTD as KOBELCO.

http://www.kobelco.co.jp/english/about_kobelco/outline/3minutes/index.html

The main visits regards Iron making process and Steel making process, Independence power producer plant.



Complete view of Kobe Steel Work



Blast Furnace

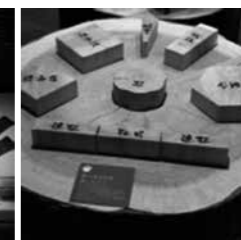


Independence power producer plant

In addition, we perform the visit of "Takenaka Carpentry Tools Museum" that attracted Japanese building culture based on Iron and Steel making manufacturing.

The Takenaka Carpentry Tools Museum was opened in 1984 in Nakayamate, Kobe, as the only museum of carpentry tools in Japan, with the objective to collect and conserve such disappearing tools as a cultural heritage, and to pass them on to the next generation through research and exhibitions.

More than 30,500 pieces of materials have been collected so far. We have been involved not only in conserving remarkable tools from the past, but also in holding diverse events such as exhibitions, lectures, seminars, classes outside of the museum, and workshops, to convey the skills, wisdom, and spirit of the people who make masterful use of tools, as well as the resulting architecture and the culture of wood that surrounds it.



Instruction for Oral/Poster Presentations

Instruction for Oral Presentations

Speaking Time

- See the Program and check your presentation time.
- It is suggested that you time the length of your speech beforehand. All speakers are kindly requested to strictly observe their allotted presentation time.
- The chair will open, time and close sessions. Speakers are requested to follow the chairs' lead.
- You are requested to be seated in a chair labeled "Next Speaker", during the presentation in prior to your own with your PC ready.

Plenary Lecture

Plenary Lecture Allotted 45 minutes in total (40 min for presentation, 5 min for Q&A)

Keynote Lecture

Keynote Lecture Allotted 30 minutes in total (25 min for presentation, 5 min for Q&A)

Oral Presentation

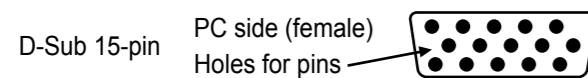
Oral Presentation Allotted 20 minutes in total (15 min for presentation, 5 min for Q&A)

Language

The official language of the conference will be English, and no interpretation to other languages will be provided.

Audio Visual Equipment

- LCD projector and a screen will be set in the room, with a podium. PC will NOT be provided.
- Make sure you bring in your own PC for lecture/presentation.
- Be sure that the PC you bring in is equipped with a D-Sub 15-pin output, a standard monitor terminal, as shown below.



- The venue will provide you with connecting cables to the projector. Set-up should be generally handled by the speaker him/herself.
- Macintosh users should bring their applicable cables and adaptors.
- If the presentation includes moving images, please make sure to test run.
- There is no need to send or register your presentation slides in advance.

Instruction for Poster Presentations

Venue for poster presentations

Reception Hall (3rd floor)

Presentation Time [October 11, 11:55 – 13:50]

- Please be sure to be available in front of your poster during your core presentation time. Your core presentation time will be indicated on your poster board.
- It will be presented in a style where the presenter stands in front of their poster. There will be no audio visual equipment made available.

Language

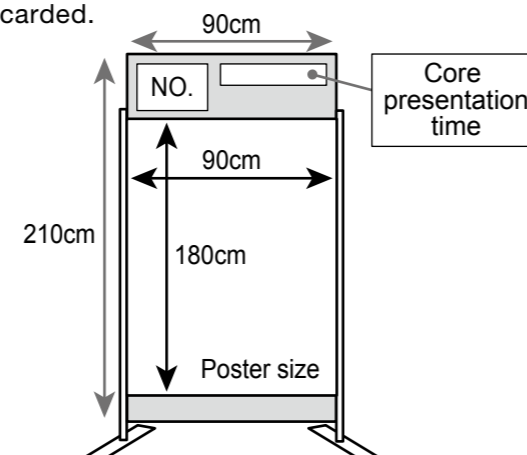
The official language of the conference will be English, and no interpretation to other languages will be provided.

Mounting & Removal

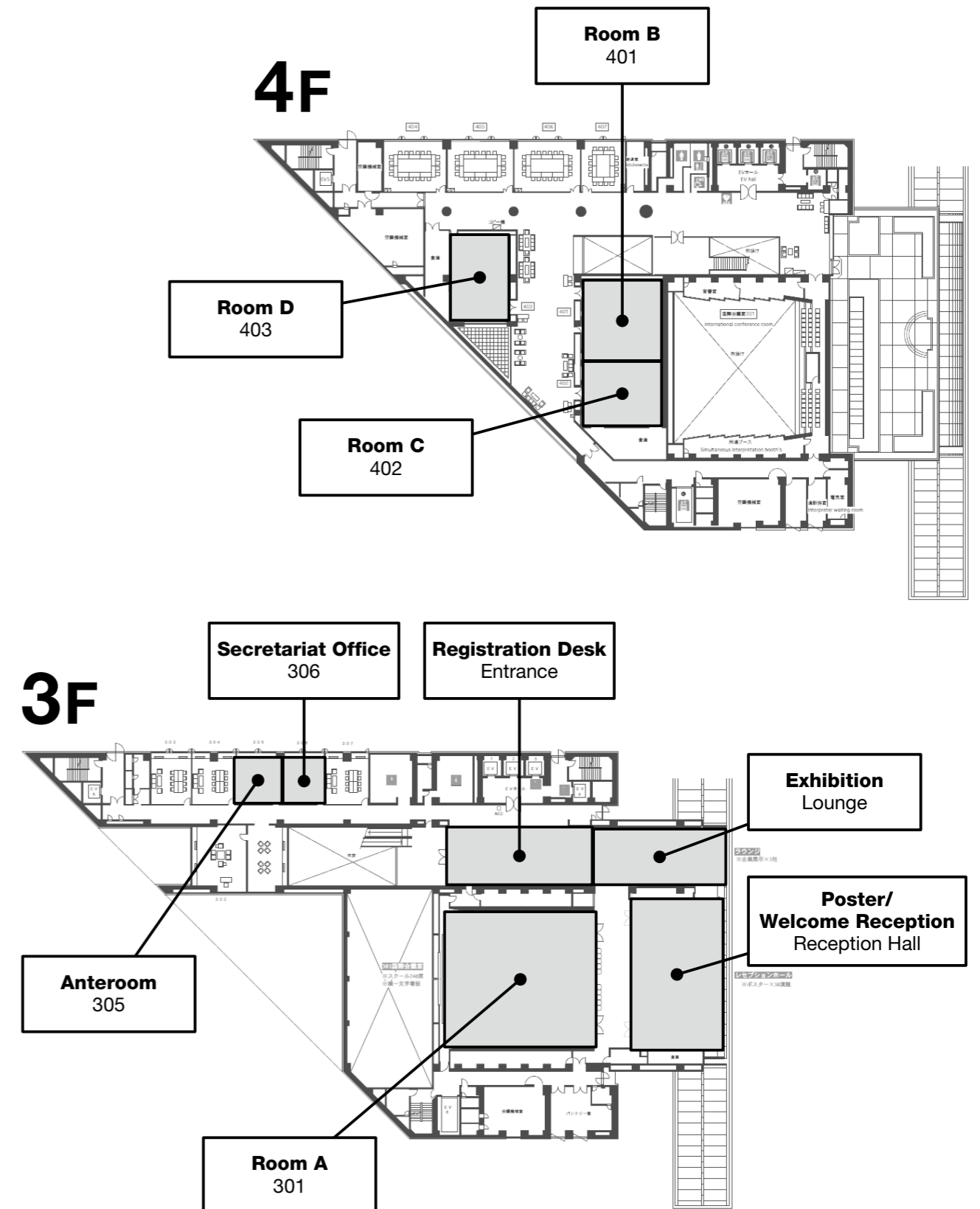
Mounting: From October 10, 15:00 until the Poster Presentation starts.

Removal: By October 13, 11:15.

- Please post your poster on the board of your poster number. The number will be available inside the Program & Abstracts booklet handed out at the venue.
- The poster can be displayed and freely left for viewing during the times indicated above.
- Limited number of Push-pin will be prepared on site.
- Posters not removed by the presenter after the Removal Time will be automatically removed and left at the registration desk until the end of the congress. Non-retrieved posters will be discarded.



Floor Map



Program at a Glance

October 11th (Wednesday)					October 12th (Thursday)				October 12th (Thursday)				October 13th (Friday)				
Time	Reception Hall	Room A 301	Room B 401	Room C 402	Room D 403	Room A 301	Room B 401	Room C 402	Room D 403	Room A 301	Room B 401	Room C 402	Room D 403	Time			
9:00														9:00			
9:10														9:10			
9:20														9:20			
9:30		Opening Address												9:30			
9:40		Plenary Lecture 1 Toshihiro Bannai												9:40			
9:50														9:50			
10:00															10:00		
10:10		Plenary Lecture 2 Hans Bodo Lungen												10:10			
10:20														10:20			
10:30															10:30		
10:40		Plenary Lecture 3 Chunxia Zhang												10:40			
10:50															10:50		
11:00															11:00		
11:10		Lunch												11:10			
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18:10		Lunch												18:10			
18:20															18:20		
18:30															18:30		
18:40		Lunch												18:40			
18:50															18:50		
19:00															19:00		
19:00	Welcome Party																

Program

October 11th (Wednesday)

Room A

9:40 - 11:55 Plenary Lectures

Chair: Takaiku Yamamoto (Kyoto University)

9:40 - 10:25 **[PL-1] Outline of COURSE 50 project**
Toshihiro Bannai* (Director General, Environment Department of New Energy and Industrial Technology Development Organization)

Chair: Yukitaka Kato (Tokyo Institute of Technology Japan)

10:25 - 11:10 **[PL-2] Paths to reduce CO₂ emissions in iron and steel making and by steel application in Germany and Europe**
Hans Bodo Lünge* (Steel Institute VDEh)

Chair: Fumitaka Tsukihashi (The University of Tokyo)

11:10 - 11:55 **[PL-3] Review on Energy Saving and CO₂ Reduction of the Chinese Steel Industry since the 21st Century**
Chunxia Zhang* (Central Iron & Steel Research Institute)

13:50 - 18:20 COURSE50

Chair: Koji Saito (Nippon Steel & Sumitomo Metal Corporation), Mutsumi Tanaka (Kobe Steel, LTD.)

13:50 - 14:20 **[11A-KL1] CO₂ Ultimate Reduction in Steelmaking Process (COURSE50 Project)**
Kyoichi Araki* (Nippon Steel & Sumitomo Metal Corporation)

14:20 - 14:40 **[11A-1] Prediction of size degradation behavior of sinter at high hydrogen utilization of blast furnace**
Yusuke Kashihara* (JFE Steel Corporation), Yuki Iwai, Takeshi Sato, Natsuo Ishiwata

14:40 - 15:00 **[11A-2] Effect of surface characteristics of reduced iron on carbon deposition reaction by CO-H₂ gas mixture**
Kazuto Nishihira* (Kyushu University), Ko-ichiro Ohno, Takayuki Maeda, Kazuya Kunitomo

15:20 - 15:40 **[11A-3] Experimental Blast Furnace Operation**
Yutaka Ujisawa* (Nippon Steel & Sumitomo Metal Corporation), Kazumoto Kakiuchi, Kohhei Sunahara, Yoshinori Matsukura, Kaoru Nakano, Hirokazu Yokoyama, Ryohta Sugitani

15:40 - 16:00 **[11A-4] Development of mathematical model for COURSE50 blast furnace and brief analyses of the 1st trial operation**
Koki Nishioka* (Nippon Steel & Sumitomo Metal Corporation), Hiroshi Sakai, Yukio Tomita, Yuki Yamashita

16:00 - 16:20 **[11A-5] Opportunities for Reducing CO₂ emissions from Steel Industry**
Jan van der Stel* (Tata Steel), Koen Meijer, Stanley Santos, Tim Peeters, Pieter Broersen

16:20 - 16:40 **[11A-6] Development of cokemaking technology for hydrogen reduction iron making process**
Takahiro Shishido* (Kobe Steel, Ltd.), Koji Sakai, Shohei Wada, Noriyuki Okuyama, Naoki Kikuchi

Chair: Yutaka Ujisawa (Nippon Steel & Sumitomo Metal Corporation), Yusuke Kashihara (JFE Steel Corporation)

17:00 - 17:20 **[11A-7] Combined Coal Gasification and COG Reforming for Production of High Temperature Reductive Gas**
Zhancheng Guo* (University of Science and Technology Beijing), Lei Guo

17:20 - 17:40 **[11A-8] Hydrogen amplification technology development using coke oven gas (COG)**
Kenji Nakao* (Nippon Steel & Sumitomo Metal Corporation), Mamoru Kasugai, Kimihito Suzuki, Nobuaki Ito, Hitoshi Donomae

17:40 - 18:00 **[11A-9] Development of CO₂ capture and separation technology in COURSE50 project**
Kazukuni Hase* (JFE Steel Corporation), Kyouichi Araki, Natsuo Ishiwata, Shigeaki Tonomura

18:00 - 18:20 **[11A-10] Development of process for heat recovery from steelmaking slag**
Yasutaka Ta* (JFE Steel Corporation), Nobuyuki Shigaki, Ikuhiro Sumi

Room B

13:50 - 18:00 Thermodynamics and Process Technology for Sustainable and Efficient Steel Refining and Recycling

Chair: Sun-Joong Kim (Chosun University), Shigeru Ueda (Tohoku University)

13:50 - 14:20 **[11B-KL1] Perspectives of Global Optimization of EAF Steelmaking: from Process to Recycling**
Joonho Lee* (Korea University), Sang Cheol Shim, Youn-Bae Kang, Dong-Joon Min, Chongku Yi, Seok Gyu Sohn

14:20 - 14:40 **[11B-1] Interaction between tramp element and alloying elements in iron**
Hideki Ono* (Osaka University), Hirokazu Konishi, Takaaki Maeda

14:40 - 15:00 **[11B-2] Effect of SrO addition to the CaO-Al₂O₃-SiO₂ slag on desulfurization of plain carbon steel**
Ahmadreza Amini* (Kyushu University), Takayuki Maeda, Ko-ichiro Ohno, Alireza Zakeri, Kazuya Kunitomo

Chair: Hideki Ono (Osaka University), Joonho Lee (Korea University)

15:20 - 15:40 **[11B-3] Measurement of interaction parameters between Al and Cu, Al and Sn in molten high Al steel**
Shigeru Ueda* (Tohoku University), Kengo Sugiyama, Xu Gao, Sun-Joong Kim, Shin-ya Kitamura

15:40 - 16:00 **[11B-4] A study on the relationship between sulfide capacity and degree of polymerization in CaO-SiO₂-Al₂O₃-MgO slags**
Sunghee Lee* (Yonsei university), Dong Joon Min

16:00 - 16:20 **[11B-5] A Computational study to estimate the possibilities to improve utilisation of stainless steelmaking slags**
Eetu-Pekka Heikkinen* (University of Oulu), Virpi Leinonen, Pekka Tanskanen, Timo Fabritius

Chair: Hiroyuki Matsuura (The University of Tokyo), Masanori Suzuki (Osaka University)

17:00 - 17:20 **[11B-6] Enhanced combustion technology for BFG and COG recovery in steel reheating furnaces**
Francesco Dentella* (Swiss Melting Technologies SA)

17:20 - 17:40 **[11B-7] The prediction of ettringite formation from a blast furnace slag under wet alkaline environments**
Aya Harashima* (Waseda University), Moeko Tennichi, Sara Arakawa, Kimihisa Ito

17:40 - 18:00 **[11B-8] Comparison of Simulation models for efficient ladle refining process**
Sun-Joong Kim* (Chosun University), Piotr R. Scheller, Shin-ya Kitamura

Room C

13:50 - 18:20 Thermal Energy Utilization

Chair: Takahiro Nomura (Hokkaido University)

13:50 - 14:20 **[11C-KL1] Recent Advances in Thermochemical Energy Storage Technologies**
Keiko Fujioka* (Functional Fluids Ltd.)

Chair: Yukitaka Kato (Tokyo Institute of Technology)

14:20 - 14:50 **[11C-KL2] Heat transfer enhancement of thermal energy storage phase change material**
Zhonghao Rao* (China University of Mining and Technology), Yutao Huo, Chenzhen Liu

Chair: Qi Zhang (Northeastern University), Koichi Nakaso (Okayama University)

15:20 - 15:40 **[11C-1] Development of Latent Heat Storage System with High Heat Release Rate by Scraping Solidified Layer of PCM**
Taichi Tsutsumi, Nobuhiro Maruoka, Akihisa Ito, Miho Hayasaka, Kensuke Yamamoto* (Tohoku University), Hiroshi Nogami

15:40 - 16:00 **[11C-2] Combined Convection Heat Transfer of Microcapsule Slurry in a Horizontal Duct : Effects of Duct Height**
Hyungsup Im* (Okayama University), Akihiko Horibe, Naoto Haruki, Yutaka Yamada, Shintaro Maeda

- 16:00 - 16:20 **[11C-3] Development of high thermal conductivity phase change materials to utilize exhaust heat from steelworks**
Takahiro Nomura* (Hokkaido University), Nan Sheng, Hiroki Sakai, Yuta Hasegawa, Tomohiro Akiyama
- 16:20 - 16:40 **[11C-4] Development of Iron-Based Heat Storage Materials Utilizing Solid Phase Transformation for Rapid Carbonization Process of Biomass**
Daisuke Maruoka* (Tohoku University), Hiroki Tsuneda, Taichi Murakami, Eiki Kasai
- Chair:* Armando Vazquez (Tenova Goodfellow Inc.), Hiroki Takasu (Tokyo Institute of Technology)
- 17:00 - 17:20 **[11C-5] Kinetic analysis of carbonation of lithium orthosilicate for thermochemical energy storage material**
Hiroki Takasu* (Tokyo Institute of Technology), Hitoshi Hoshino, Yoshiro Tamura, Yukitaka Kato
- 17:20 - 17:40 **[11C-6] Effect of the bridge formed between particles on heat transfer enhancement and gas permeability in the packed bed reactors**
Koichi Nakaso* (Okayama University), Kuniaki Gotoh
- 17:40 - 18:00 **[11C-7] Energy efficiency improvement and CO₂ emission reduction in China's iron and steel industry**
Qi Zhang* (Northeastern University), Jin Xu, Yujie Wang, Wei Zhang
- 18:00 - 18:20 **[11C-8] Improving Yield and Productivity While Reducing GHG Emissions and Operational Cost Using Off-gas Technology in EAF Steelmaking**
Armando Vazquez* (Tenova Goodfellow Inc.), Igor Todorovic

Room D

- 13:50 - 16:20 **Phosphorus Concentration and Recovery from Steel-making Slag**
Chair: Kazuyo Matsubae (Tohoku University), Takahiro Miki (Tohoku University)
- 13:50 - 14:20 **[11D-KL1] P innovation - Sustainable phosphorus value chain based on recycling -**
Hisao Ohtake* (Waseda University), Satoshi Tsuneda, Hirotsugu Fujitani
- 14:20 - 14:40 **[11D-1] Extraction of Phosphorus from Dephosphorization Slag**
Takaiku Yamamoto* (Kyoto University), Masashi Nakamoto
- 14:40 - 15:00 **[11D-2] A New Steelmaking Slag Recycling System for Iron and Phosphorus Separation (Fundamental Research)**
Yuji Miki* (JFE Steel Corporation), Kenji Nakase, Akitoshi Matsui, Naoki Kikuchi, Yu-Ichi Uchida
- 15:20 - 15:40 **[11D-3] Reduction of Steelmaking Slag using Closed type DC Arc Furnace**
Toshiya Harada* (Nippon Steel & Sumitomo Metal Corporation), Hiroshi Hirata, Takashi Arai, Tsuyoshi Yamazaki
- 15:40 - 16:00 **[11D-4] Hidden phosphorus flow caused by steelmaking activity**
Kazuyo Matsubae* (Tohoku University), Elizabeth Webeck, Eiji Yamasue, Takahiro Miki, Tetsuya Nagasaka
- 16:00 - 16:20 **[11D-5] Separation of phosphorus from synthetic steelmaking slag by selective leaching**
Xu Gao* (Tohoku University), Chuan-ming Du, Masanori Numata, Takayuki Iwama, Sun-joong Kim, Shigeru Ueda, Shin-ya Kitamura
- 17:00 - 18:00 **Behavior of Accompanied Element in Steel Cycle**
Chair: Eiji Yamasue (Ritsumeikan University), Alicia Sakurako Gauffin (KTH Royal Institute of Technology)
- 17:00 - 17:20 **[11D-6] Identification of end-of-life products causing tramp element contamination in carbon steel**
Satoshi Ohta* (The University of Tokyo), Ichiro Daigo, Yoshikazu Goto
- 17:20 - 17:40 **[11D-7] Estimation of possibility of steel scrap as secondary resource of Ni and Cr**
Kentaro Takeyama* (Tohoku University), Hajime Ohno, Kazuyo Matsubae, Kenichi Nakajima, Yasushi Kondo, Tetsuya Nagasaka
- 17:40 - 18:00 **[11D-8] Optimization of steel scrap use by focusing on alloying elements with IO-MFA based linear programming towards the development of sustainable steel cycle in our society**
Hajime Ohno* (Tohoku University), Kazuyo Matsubae, Kenichi Nakajima, Yasushi Kondo, Shinichiro Nakamura, Tetsuya Nagasaka

Reception Hall

11:55 - 13:50 **Poster Presentation**

Ironmaking Resources and Preparation Process

- [P-1] Effective Utilization of Dust and Sludge Formed in Ironmaking to Iron Ore Sintering Process**
Tsubasa Shima* (Tohoku University), Sanghan Son, Daisuke Maruoka, Taichi Murakami, Eiki Kasai
- [P-2] Effect of MgO Content on Metallurgical Properties and Microstructure of V-Ti Bearing Sinter**
Yao-zu Wang* (University of Science and Technology Beijing), Jian-liang Zhang, Zheng-jian Liu, Ya-peng Zhang, Dong-hui Liu, Cheng-bo Du
- [P-3] Effects of MgO on combustion reactivity of demineralized anthracite and its kinetic analysis**
Peng Wang* (University of Science and Technology Beijing), Jianliang Zhang, Guangwei Wang, Runsheng Xu, Zhengjian Liu
- [P-4] Preparation of high-strength carbon/carbon composites from tarry materials and low-grade cokes or pyrolyzed chars**
Jun Ma* (Hokkaido University), Yuuki Mochizuki, Naoto Tsubouchi, Kazuya Uebo
- [P-5] Reduction Mechanism of Carbon Cored Iron Ore Pellet with CO-CO₂ Gas**
Tsuyoshi Saito* (Tohoku University), Daisuke Maruoka, Taichi Murakami, Eiki Kasai

Blast Furnace Route for Future Ironmaking

- [P-6] Role of Carbon Dissolution Reaction in the Initial Contact Period of Carbon-unsaturated Fe-C Sample Wetting on Graphite Substrate**
Ko-Ichiro Ohno, Cao Son Nguyen, Takayuki Maeda* (Kyushu University), Kazuya Kunitomo
- [P-7] In situ observation of the Fe₂O₃ reduction by the materials which do not include C**
Nobuhiro Ishikawa* (National Institute for Materials Science), Tadashi Mitsui, Masaki Takeguchi, Kazutaka Mitsuishi
- [P-8] Experimental and Numerical Study on Gas-solid Flow Characteristics in Oxygen Blast Furnace**
Guang Wang, Jingsong Wang* (University of Science and Technology Beijing)
- [P-9] Recent Research Progress of Blast Furnace Cohesive Zone**
Hiroshi Nogami* (Tohoku University), Takahiro Miki, Shigeru Ueda
- [P-10] In situ X-ray diffraction evaluation of reducibilities of wustite and calcio-wustite in iron ore sinter**
Boyuan Cai* (Tokyo Institute of Technology), Takashi Watanabe, Masahiro Susa, Miyuki Hayashi

Thermodynamics and Process Technology for Sustainable and Efficient Steel Refining and Recycling

- [P-11] Determination of Zr activity coefficient in molten iron using gas / Fe-Zr alloy / ZrO₂-containing slag / ZrO₂ solid multi-phase equilibrium**
Masanori Suzuki* (Osaka University)
- [P-12] Dissolution of dicalcium silicate into molten CaO-FeO-SiO₂ slag**
Yoshinao Kobayashi* (Tokyo Institute of Technology), Takahide Sadamoto
- [P-13] Interaction between tramp element and alloying elements in iron**
Hideki Ono* (Osaka University), Hirokazu Konishi, Takaaki Maeda
- [P-14] Measurement of Interaction Parameters between Al and Cu, Al and Sn in Molten High Al Steel**
Shigeru Ueda* (Tohoku University), Kengo Sugiyama, Xu Gao, Sun-Joong Kim, Shin-ya Kitamura

COURSE50

- [P-15] Characteristics of lithium silicate prepared by rice husk ash and thermogravimetric analysis**
Haiyang Wang* (University of Science and Technology Beijing), Jianliang Zhang, Guangwei Wang
- [P-16] Utilizing Technique of Unused Exhaust Heat Generated from Steel Works (Overall Optimization)**
Ryota Murai* (JFE Steel Corporation), Naotaka Ogawa, Ikuhiro Sumi
- [P-17] Heat recovery from low-temperature off-gas using micro-channel heat exchanger**
Kazuaki Kobayashi* (Nippon Steel & Sumitomo Metal Corporation), Yuki Kuwauchi, Yuji Ogawa
- [P-18] Optimum Design of the Complex Injection Lance for COURSE50 Experimental Blast Furnace**
Akito Kasai* (Kobe Steel,Ltd), Kazuya Miyagawa, Kentaro Nozawa

Life Cycle Social Value and Environmental Impacts

[P-19] Data Envelopment Analysis for Steel Productions with The Use of Total Material Requirement for Mining Activities

Akira Oyaizu* (Ritsumeikan University), Ichiro Daigo, Cravioto Jordi, Eiji Yamasue

Behavior of Accompanied Element in Steel Cycle

[P-20] Identifying the factors of the difference of impurity element contents in steel between Japan and Netherlands

Shota Koketsu* (The University of Tokyo), Leo Fujimura, Benjamin Sprecher, Ichiro Daigo, Yoshikazu Goto

Creating Social Value Beyond Steel Industry

[P-21] Analysis of Total Material Requirement for automotive technological change

Kenyu Matsui* (Tohoku university), Akira Oyaizu, Eiji Yamasue, Kazuyo Matsubae, Tetsuya Nagasaka

[P-22] Framework for Expressing Social Value of Materials: Social Value of "TETSU"

Kenichi Nakajima* (National Institute for Environmental Studies, The University of Tokyo), Ichiro Daigo, Hiroki Hatayama, Eiji Yamasue, Kazuyo Matsubae, Yoshinao Kobayashi, Wataru Takayanagi

Thermal Energy Utilization

[P-23] Reactivity evaluation of Li-based mixed oxide with CO₂

Yuki Hanaoka* (Chiba University), Junichi Ryu

[P-24] Hydrogen Generation via Some Catalytic Reactions over Limonite Ore

Keisuke Abe* (Hokkaido University), Ade Kurniawan, Takahiro Nomura, Tomohiro Akiyama

Carbon and Material Recycling

[P-25] Development of Solid Oxide Electrolysis Cells for CO₂ reduction in an Active Carbon Recycling Energy System as applied to iron-making process

Yuichi Numata* (Tokyo Institute of Technology), Maria Caprisse Azucena Nepomuceno, Yukitaka Kato

[P-26] Intelligent Energy Saving Technology for Rolling Mill Lines

Tatsuya Tsukamoto* (Toshiba Mitsubishi-Electric Industrial systems Corporation), Hiroyuki Imanari

[P-27] New Technology for the Production of Ultra-Pure Calcium Carbonate and Sequestration of Recycled Carbon Dioxide from Steel Slag

Mike Wyrsta, Mark Tilley, Takashi Murayama* (Lixivia Inc.)

Gas Separation by PCPs/MOFs for the Steel Industry

[P-28] CO₂ gas separation using PCPs/MOFs with fluorinated anions

Shin-ichiro Noro* (Hokkaido University), Xin Zheng, Takayoshi Nakamura

[P-29] JST ACCEL Project for Gas Separation by PCPs/MOFs

Takaiku Yamamoto, Mari Inoue* (Japan Science and Technology Agency)

[P-30] A new synthesis process of Ethylene Glycol from Carbon mono-Oxide

Jianyu Chai* (Highchem Company Ltd.), Sun Li, Yoshio Taguchi

Phosphorus Concentration and Recovery from Steel-making Slag

[P-31] Separation of iron oxide and phosphorus oxide from steelmaking slag by capillary action

Takahiro Miki* (Tohoku University)

[P-32] Separation of phosphorus oxide from steelmaking slag by porous CaO absorber

Aoi Oashi* (Tohoku University), Takahiro Miki, Tetsuya Nagasaka

October 12th (Thursday)

Room A

9:00 - 9:45 Plenary Lectures

Chair: Eiki Kasai (Tohoku University)

9:00 - 9:45 [PL-4] Steel industry in Brazil – development, challenges and opportunities

Paulo Santos Assis* (Federal University of Ouro Preto/Materials, Metallurgy and Mining Brazilian Association)

9:55 - 12:35 Blast Furnace Route for Future Ironmaking

Chair: Hiroshi Nogami (Tohoku University)

9:55 - 10:25 [12A-KL1] Energy and mass balance evaluation of actions for efficiency improvement of blast furnace ironmaking process

Kazuya Kunitomo* (Kyushu University)

10:25 - 10:55 [12A-KL2] A New Direct Reduction Technology with Low Carbon Rate

Fengman Shen* (Northeastern University), Li Zhang, He Guo, Qiulin Wen, Haiyan Zheng, Qiangjian Gao, Xin Jiang

Chair: Kazuya Kunitomo (Kyushu University), Fengman Shen (Northeastern University)

11:15 - 11:35 [12A-1] Technical Development of Low Carbon and Greenization Blast Furnace Ironmaking

Zhang Fuming* (Shougang Group Co., Ltd.), Meng Xianglong, Hu Zurui

11:35 - 11:55 [12A-2] Recent Research & Development topics of Iron-making Technologies in NSSMC

Koji Saito* (Nippon Steel & Sumitomo Metal Corporation)

11:55 - 12:15 [12A-3] An approach to hydrogen reduction using the off-gas of iron-making process

Jonghwun Jung* (POSCO), Seungmoon Lee

12:15 - 12:35 [12A-4] Modelling of blast furnace process modification for lowering CO₂ emissions from integrated steel plant

Joel Orre* (Swerea MEFOS), Lena Sundqvist, Mats Bramming, Bo Sundelin, Per Lagerwall, Bo Bjorkman

13:35 - 14:20 Plenary Lectures

Chair: Hiroshi Nogami (Tohoku University)

13:35 - 14:20 [PL-5] FINEX® as a Solution to Steel Industry's Challenge

Sang-Ho Yi* (POSCO)

14:25 - 17:55 Ironmaking Resources and Preparation Process

Chair: Masaru Matsumura (Nippon Steel & Sumitomo Metal Corporation), Takayuki Maeda (Kyushu University)

14:25 - 14:55 [12A-KL3] Recent Studies on Preparation Process of Raw Materials for Iron Ore Sinter

Eiki Kasai* (Tohoku University)

14:55 - 15:15 [12A-5] Recent advances in utilisation of biomass materials in steel production

Liming Lu* (CSIRO Mineral Resources)

15:15 - 15:35 [12A-6] Effect on coke when using biomass as part of the blend

Maria Lundgren* (Swerea MEFOS AB), Lena Sundqvist Ökvist, Alexandra Hirsch, Janaina Brum, Ahmet Y. Gunbati, Katarina Pein, Anna Dahlstedt, Johanna Alatalo, Astrid Mata, Caisa Samuelsson, Bo Björkman

15:35 - 15:55 [12A-7] Optimization of Coal Briquettes for Lower Reactivity and Higher Strength under Melter-gasifier Conditions

Anrin Bhattacharyya* (Montanuniversitaet Leoben), Hado Heckmann, Johannes Schenk, Johann Wurm

Chair: Takahide Higuchi (JFE Steel Corporation), Liming Lu (CSIRO)

16:35 - 16:55 [12A-8] Glycerin-Ethanol Blending on Temperature Programmed Decomposition over Low-Grade Iron Ores

Ade Kurniawan* (Hokkaido University), Keisuke Abe, Koichi Ohashi, Takahiro Nomura, Tomohiro Akiyama

16:55 - 17:15 [12A-9] Development of gas analysis method for solid fuel combustion reaction

Yasuhiro Tobu* (Nippon Steel & Sumitomo Metal Corporation)

- 17:15 - 17:35 **[12A-10] Sustainable and environmentally friendly production of high grade iron ore pellet, for improved blast furnace operation**
Mikael Pettersson* (LKAB), Peter Sikström
- 17:35 - 17:55 **[12A-11] Efficient Bonding Agents Application with Intensified Granulation Technique**
Osamu Ishiyama* (Nippon Steel & Sumitomo Metal Corporation), Kenichi Higuchi, Tsutomu Okada, Seiji Nomura

Room B

10:05 - 18:15 Carbon and Material Recycling

Chair: Yukitaka Kato (Tokyo Institute of Technology)

- 10:05 - 10:35 **[12B-KL1] Development of Cogeneration High Temperature Gas-cooled Reactor for Decarbonization**
Kazuhiko Kunitomi* (Japan Atomic Energy Agency), Tetsuo Nishihara, Yukio Tachibana, Xing Yan, Taiju Shibata, Hirofumi Ohashi, Shinji Kubo, Hiroyuki Sato
- Chair:* Ichiro Yamanaka (Tokyo Institute of Technology), Ryosuke O. Suzuki (Hokkaido University)
- 10:35 - 10:55 **[12B-1] Development of low carbon emission and material saving ironmaking system, SMART**
Yukitaka Kato* (Tokyo Institute of Technology), Hiroshi Nogami
- 11:15 - 11:35 **[12B-2] Quantitative evaluation of SMART steelmaking system by sensitivity analysis of operating conditions on CO₂ emissions and exergy**
Shinnosuke Hisashige* (Waseda University), Junpei Katayama, Takao Nakagaki
- 11:35 - 11:55 **[12B-3] A mechanism model for accurately estimating carbon emissions on a micro scale of the steel industrial system**
Gang Zhao* (Wuhan University of Science and Technology/Hubei Key Laboratory of Mechanical Transmission and Manufacturing Engineering), Dan Ruan, Xing Gao
- 11:55 - 12:15 **[12B-4] Conversion of CO₂ to CO gas using molten CaCl₂ and ZrO₂ anode**
Ryosuke O. Suzuki* (Hokkaido University), Fumiya Matsuura, Shungo Natsui, Tatsuya Kikuchi
- Chair:* Dongfeng He (University of Science and Technology Beijing), Takao Nagasaki (Waseda University)
- 14:35 - 14:55 **[12B-5] Conversion of carbon dioxide and water to carbon monoxide and oxygen by electrolysis using Co-N-C electrocatalysts**
Ichiro Yamanaka* (Tokyo Institute of Technology), Tomomi Maezuru, Yuji Ogishima, Hitoshi Ogihara
- 14:55 - 15:15 **[12B-6] Melting behaviour observation of iron contacted with different kinds of carbonaceous materials under loading condition**
Ko-ichiro Ohno* (Kyushu university), Shinya Miura, Takayuki Maeda, Kazuya Kunitomo
- 15:15 - 15:35 **[12B-7] Leaching of copper in an ammonia solution containing ammonium chloride or sulfate**
Hirokazu Konishi* (Osaka University), Hideki Ono, Takashi Bitoh
- 15:35 - 15:55 **[12B-8] Leaching behavior of waste electric arc furnace (EAF) stainless steel slag by ammonium salts under microwave radiation**
Xiang Zhang* (Wuhan University of Science and Technology), Guojun Ma, Qinan Li, Zhi Li
- 15:55 - 16:15 **[12B-9] Preparation of Ti alloy from Ti-bearing blast furnace slag using carbon, Al₂O₃ and MgO saturated aluminothermic-reduction technology**
Yun Lei* (Kunming University of Science and Technology), Luen Sun, Kuixian Wei, Wenhui Ma
- Chair:* Guojun Ma (Wuhan University of Science and Technology), Yukitake Kato (Tokyo Institute of Technology)
- 16:35 - 16:55 **[12B-10] Molten slag property estimation using deep neural networks for advanced material recycling**
Corey Adam Myers* (Waseda University), Takao Nakagaki
- 16:55 - 17:15 **[12B-11] Effect of carbonaceous reductants on the energy consumption of the silicon furnace**
Wenhui Ma* (Kunming University of Science and Technology), Zhengjie Chen, Kuixian Wei
- 17:15 - 17:35 **[12B-12] Enrichment of CO from blast furnace gas by VPSA using adsorbent PU-1**
Tang Wei* (Peking University/Pioneer Technology Company), Geng Yunfeng, Lü Changzhong, Li Tengjiao, Zhang Jiaping, Xie Youchang
- 17:35 - 17:55 **[12B-13] Introduction of biomass lignin to blast furnace process as cement substitute in cold-bonded briquettes**
Antti Kemppainen* (University of Oulu), Elsayed Mousa, Chuan Wang, Hannu Suopajarvi, Mikko Iljana, Eetu-Pekka Heikkinen, Timo Fabritius
- 17:55 - 18:15 **[12B-14] Decomposition of Glycerol to High Calorific Gas Catalyzed by Iron Ore**
Hirokazu Eguchi* (Kyushu University), Tatsuya Kon, Hitoshi Saima, Ikuhiro Sumi, Yasuhiro Mogi

Room C

9:55 - 15:15 Life Cycle Social Value and Environmental Impacts

Chair: Ichiro Daigo (The University of Tokyo), Jean-Pierre Birat (IF Steelman)

- 9:55 - 10:25 **[12C-KL1] Thinking Life Cycle in a Circular Economy**
Louis George Brimacombe* (IOM3)
- 10:25 - 10:55 **[12C-KL2] Conditions of Material Recycling, and Material LCA reflecting Recycling**
Toru Ono* (Nippon Steel and Sumitomo Metal Corporation), Toshio Isohara
- 11:15 - 11:45 **[12C-KL3] The steel eco cycle - A Swedish initiative for closing the loop**
Alicia Sakurako Gauffin* (KTH Royal Institute of Technology)
- 11:45 - 12:15 **[12C-KL4] Musica Universalis, the Music of the spheres**
Jean-Pierre Birat* (If Steelman)
- 14:35 - 14:55 **[12C-1] Development of a new LCA framework for materials**
Ichiro Daigo* (The University of Tokyo), Kenichi Nakajima, Eiji Yamasue, Kazuyo Matsubae, Hiroki Hatayama, Yoshinao Kobayashi
- 14:55 - 15:15 **[12C-2] Assessment and Study on the Impact on Environment by Multi-crystalline Silicon Preparation by Metallurgical Route**
Kuixian Wei* (Kunming University of Science and Technology), Zhiqiang Yu, Wenhui Ma
- 15:25 - 17:55 **Creating Social Value Beyond Steel Industry**
- Chair:* Kenichi Nakajima (National Institute for Environmental Studies), Nicole Kinsman (International Molybdenum Association)
- 15:25 - 15:55 **[12C-KL5] Reducing water loss with corrugated stainless steel service pipe**
Nicole Kinsman* (International Molybdenum Association), Richard Matheson, Gary Coates, Shinji Esaki
- 15:55 - 16:15 **[12C-3] The total anticorrosive function performed by steel stock in use**
Ichiro Daigo, Yumi Aduma, Yoshikazu Goto* (The University of Tokyo)
- 16:35 - 16:55 **[12C-4] Industrial symbiosis of steel and cement production in Vietnam**
Jordi Cravioto* (Ritsumeikan University), Duc-Quang Nguyen, Tran-Duc Huy, Eiji Yamasue, Akira Oyaizu, Ichiro Daigo
- 16:55 - 17:15 **[12C-5] Nitrogen flow analysis focused on by-product ammonia from steel industry**
Kiwamu Katagiri* (Tohoku university), Kazuyo Matsubae, Tetsuya Nagasaka
- 17:15 - 17:35 **[12C-6] A new model to explore time-series changes in demand for material based on services**
Yosuke Kawamura* (The University of Tokyo), Ichiro Daigo, Yoshikazu Goto
- 17:35 - 17:55 **[12C-7] Development of a criticality assessment method for materials**
Masato Nakada* (The University of Tokyo), Ichiro Daigo, Yoshikazu Goto, Hiroki Hatayama

Room D

11:15 - 12:15 COURSE50

Chair: Yutaka Ujisawa (Nippon Steel & Sumitomo Metal Corporation), Yusuke Kashihara (JFE Steel Corporation)

- 11:15 - 11:35 **[12D-1] Development of CO₂ chemical absorption technology**
Yoichi Matsuzaki* (Nippon Steel & Sumitomo Metal Corporation), Firoz Alam Chowdhury, Kazuya Goto, Hidetaka Yamada, Shin Yamamoto, Takayuki Higashii, Masami Onoda
- 11:35 - 11:55 **[12D-2] Development of CO₂ physical adsorption technology**
Nobuyuki Shigaki* (JFE Steel Corporation), Yasuhiro Mogi, Takashi Haraoka, Ikuhiro Sumi
- 11:55 - 12:15 **[12D-3] Consideration of the scale-up of the entire COURSE50 system**
Shigeaki Tonomura* (Nippon Steel & Sumitomo Metal Corporation), Ryota Murai, Mutsumi Tanaka, Yukio Tomita, Shin Tomisaki

15:15 - 16:15 Thermodynamics and Process Technology for Sustainable and Efficient Steel Refining and Recycling

Chair: Noritaka Saito (Kyushu University), Gao Xu (Tohoku University)

- 15:15 - 15:35 **[12D-4] Dissolution of dicalcium silicate into molten CaO-FeO-SiO₂ slag**
Yoshinao Kobayashi* (Tokyo Institute of Technology), Takahide Sadamoto
- 15:35 - 15:55 **[12D-5] Compositions of liquid phases and activities of components in the CaO-SiO₂-P₂O₅-FeO heterogeneous slags coexisted with Ca₂SiO₄-Ca₃P₂O₈ solid solutions**
Masakatsu Hasegawa* (Kyoto University), Kohei Miwa, Ryota Matsugi
- 15:55 - 16:15 **[12D-6] Deoxidation equilibrium of molten Fe-Mn-Al alloy at steelmaking and casting temperature**
Hiroyuki Matsuura* (The University of Tokyo), Sho Higuchi

16:35 - 18:15 Blast Furnace Route for Future Ironmaking

Chair: Ko-ichiro Ohno (Kyushu University), Jonghwun Jung (POSCO)

- 16:35 - 16:55 **[12D-7] Experimental Blast Furnace Operation with Ore-Coke Mixed Layer**
Takuya Natsui* (Nippon Steel & Sumitomo Metal Corporation), Kaoru Nakano, Yoshinori Matsukura, Kohei Sunahara, Yutaka Ujisawa
- 16:55 - 17:15 **[12D-8] Effect of CH₄ injection to blast furnace tuyere on pulverized coal ignition**
Koichi Takahashi* (JFE Steel Corporation), Akinori Murao, Yusuke Kashihara, Nobuyuki Oyama, Hidetoshi Matsuno, Michitaka Sato
- 17:15 - 17:35 **[12D-9] Alternative auxiliary bio-based reducing agents for pulverized coal injection**
Hesham Ahmed* (Lulea University of technology), Martin Ölund, Lena Sundqvist Ökvist, Bo Björkman

Chair: Hiroshi Nogami (Tohoku University), Hesham Ahmed (Lulea University of technology)

- 17:35 - 17:55 **[12D-10] Effect of Reactivity of Carbonaceous Material in Iron Ore/Carbon Composite on the Reduction Rate in the Temperature Range of 800-1000°C**
Soon-Mo Shin, Min-Woo Choi* (Graduate Institute of Ferrous Technology), Sung-Mo Jung
- 17:55 - 18:15 **[12D-11] A direct numerical simulation of trickle flow in cokes bed**
Sungo Natsui* (Hokkaido University), Akinori Sawada, Tatsuya Kikuchi, Ryosuke O. Suzuki

October 13th (Friday)

Room A

9:00 - 9:45 Plenary Lectures

Chair: Takaiku Yamamoto (Kyoto University)

- 9:00 - 9:45 **[PL-6] Chemistry and Application of Porous Coordination Polymers/Metal-Organic Frameworks**
Susumu Kitagawa* (Kyoto University)

9:55 - 11:55 Gas Separation by PCPs/MOFs for the Steel Industry

Chair: Masaya Matsuoka (Osaka Prefecture University), Ryotaro Matsuda (Nagoya University)

- 9:55 - 10:15 **[13A-1] Cu(II) porous coordination polymers as adsorbents for CO/N₂ separation**
Shinpei Kusaka* (Kyoto University)
- 10:15 - 10:35 **[13A-2] Selective gas recognition and separation by porous coordination polymers**
Ryotaro Matsuda* (Nagoya University), Akihiro Hori, Yunsheng Ma
- 10:35 - 10:55 **[13A-3] CO₂ Capture using a Gate Type PCP/MOF**
Hiroshi Kajiro* (Nippon Steel & Sumitomo Metal Corporation)
- 11:15 - 11:35 **[13A-4] Fundamental Study of Transportation Phenomenon on CO₂ PSA System**
Ryo Matsuura* (Kyushu University/JFE Steel), Tatsuya Kon, Hitoshi Saima
- 11:35 - 11:55 **[13A-5] Shaped Porous Coordination Polymer Composites with Macroporous Solid Materials: Synthetic Approach and Application**
Yu Horiuchi* (Osaka Prefecture University), Dang Do Van, Makoto Katagiri, Masaya Matsuoka

Room B

9:55 - 12:15 Blast Furnace Route for Future Ironmaking

Chair: Koichi Takahashi (JFE Steel Corporation), Fuming Zhang (Shougang Group)

- 9:55 - 10:15 **[13B-1] Hot blast superheating – A scalable technology to reduce carbon consumption**
Ian Cameron, Mitren Sukhrum* (Hatch Ltd.), Barry Hyde, John Busser, Alex Gorodetsky
- 10:15 - 10:35 **[13B-2] A Critical Review of the Oxygen Blast Furnace Process**
Wei Zhang* (Wuhan University of Science and Technology), Jing Dai, Jindong Zhou, Wei Wang, Zhengliang Xue
- 10:35 - 10:55 **[13B-3] Towards High Productivity in Full Oxygen Blast Furnace Based on Synergy Enhancement of Energy-Mass Transfer and Chemical Reaction**
Piao Li, Junkai He,
Zeyi Jiang* (University of Science and Technology Beijing/Beijing Engineering Research Center of Energy Saving and Environmental Protection), Jingsong Wang, Xinxin Zhang

Chair: Takuya Natsui (Nippon Steel & Sumitomo Metal Corporation), Hiroshi Nogami (Tohoku University)

- 11:15 - 11:35 **[13B-4] Increasing the proportion of lump ores in blast furnace by improving the characteristics of primary-slugs**
Binbin Du* (University of Science and Technology Beijing), Shengli Wu, Laixin Wang, Kai Gu, Yanan Lu
- 11:35 - 11:55 **[13B-5] Reduction of carbon footprint of 'i' blast furnace by theimproving the process efficiency and reliability of energy-saving equipment**
Subhachandhar S* (Tata Steel Ltd), Dhiren Patnaik, P Jaya Krishna, Santosh Kumar Lal, Basant Kumar Singh, Vineet Ranjan Tripathi, Amit Kumar Singh
- 11:55 - 12:15 **[13B-6] Reduction of Material and Utilities Consumption by Optimization of the usage at 'I' Blast Furnace**
Vineet Ranjan Tripathi, Basant Kumar Singh* (Tata Steel Ltd), Rajkumar Vishwakarma, Narayana Chandra Sinha, Anil Singh, Satish Kumar, Ujjal Ghosh, Subhachandhar S

Room C

9:55 - 11:55 Ironmaking Resources and Preparation Process

Chair: Taichi Murakami (Tohoku University), Osamu Ishiyama (Nippon Steel & Sumitomo Metal Corporation)

9:55 - 10:15 [13C-1] New Granulation Process Aiming at Uniform Size Distribution for Utilizing Fine Iron Ores

Takahide Higuchi* (JFE Steel Corporation), Naoyuki Takeuchi, Yusuke Ishigaki, Tetsuya Yamamoto, Hidetoshi Matsuno, Nobuyuki Oyama

10:15 - 10:35 [13C-2] Evaluation of Dynamic Cohesive Properties of Iron Ore Powders

Takeyuki Fujisaka* (Nippon Steel & Sumitomo Metal Corporation), Hiroshi Mio, Kenichi Higuchi, Seiji Nomura

10:35 - 10:55 [13C-3] A study on the gas reduction behaviour of calcined limonite by H₂-Ar and H₂-CO mixtures

Sang Gyun Shin* (Yonsei University), Dong Joon Min

11:15 - 11:35 [13C-4] Reduction behaviors of iron ore pellets containing coal under different heating rates

Hao Hsun Chang* (University Rd), In-Gann Chen, Chi-Hao Wang, Ke-Miao Lu, Shih-Hsien Liu

11:35 - 11:55 [13C-5] A possible method for the controlling of carburization content of pig iron nugget: a new finding

Guang Wang* (University of Science and Technology Beijing), Jingsong Wang, Qingguo Xue

Room D

9:55 - 12:15 Thermodynamics and Process Technology for Sustainable and Efficient Steel Refining and Recycling

Chair: Masakatsu Hasegawa (Kyoto University), Dr. Masashi Nakamoto (Osaka University)

9:55 - 10:15 [13D-1] Dissolution rate of CO₂ controlled spherical quicklime into molten slag

Nobuhiro Maruoka* (Tohoku University), Akihisa Ito, Miho Hayasaka, Hiroshi Nogami

10:15 - 10:35 [13D-2] Rheological Behavior of Foaming Slag

Yusuke Harada, Noritaka Saito* (Kyushu University), Kunihiro Nakashima

10:35 - 10:55 [13D-3] Slag foaming behaviors in EAF process using DRI addition

Won Yeong Son, Youngjo Kang* (Dong-A University)

Chair: Yoshinao Kobayashi (Tokyo Institute of Technology), Youngjo Kang (Dong-A University)

11:15 - 11:35 [13D-4] Converter slag recycling by tuyere injection in high PC rate operation at Kobe No.3 blast furnace

Nayuta Mitsuoka* (Kobe Steel Ltd), Kota Tanaka, Tomonori Maeda, Hitoshi Toyota, Atsushi Sato, Tadasu Matsuo

11:35 - 11:55 [13D-5] Numerical simulation of flow characteristics of partially solidified steelmaking slag for the recovery of its sensible heat

Yuichi Tsurukawa* (Waseda University), Masahiro Tsuboi, Ito Kimihisa

11:55 - 12:15 [13D-6] Estimation of thermodynamic parameters in liquid iron

Masashi Nakamoto* (Osaka University), Toshihiro Tanaka