Scrap & Substitutes & Alternative Ironmaking V

AIST

November 2–4, 2008
Baltimore, Md.

2008 Specialty Training Conference

Scrap Substitutes & Alternative Ironmaking V

Any audio and/or video recording of sessions is strictly prohibited.

FOCUS
Development and application of alternative ironmaking process to provide virgin iron units to the electric arc furnace sector or press waste oxides in both blast furnace–based and EAF steel plants.

ABOUT THE PROGRAM
This is the fifth in a series of symposia covering scrap substitutes and alternative ironmaking, originating with a meeting in Myrtle Beach, S.C., in 1993. The previous symposia, which were international in scope and participation, were associated with a high level of activity in research, process and project development, plant construction and start-up of direct reduction and alternative ironmaking processes. These were mainly aimed at supplying virgin iron units to feed the growth of electric furnace flat rolled steel production worldwide. This symposium will focus on the following areas: successful projects/processes; processes still under development and new approaches; and use of products.

WHO SHOULD ATTEND
Those engaged in the production, sale and use of direct reduced iron, pig iron and scrap; managers and engineers from electric furnace and blast furnace–based steel companies, suppliers of iron ore, coal and natural gas; steel company, engineering company, academic and research institute personnel engaged in ironmaking process development.

REGISTRATION FEES
Advance registration by October 3, 2008: Member US$845, Nonmember US$995. Registration after October 3, 2008: Member US$945, Nonmember US$1,095. Registration fee includes a welcome reception on Sunday evening, continental breakfasts and lunches Monday and Tuesday, a reception on Monday evening, and a seminar workbook.

HOTEL ACCOMMODATIONS
A block of rooms has been reserved at the Renaissance Harborplace Hotel. Please call the Renaissance at (800) 468-3571 by October 10, 2008, to secure the AIST discount rate of US$169 per night for single/double occupancy.

PROFESSIONAL DEVELOPMENT HOURS
This course may qualify for up to 13 Professional Development Hour (PDH) credits. Each attendee will receive a certificate listing the quantity of PDH credits earned for this course. This course is not approved for PDH credit in New York, Florida, North Carolina and Oklahoma.

ATTENTION NONMEMBERS
Nonmember registrants will have the opportunity to join AIST on-site at the conference with 2009 membership dues waived. Membership is not automatic. A completed membership application must be returned to AIST on-site.

COMPANY DISCOUNT
Three or more individuals from the same facility attending any one seminar can receive a 10% discount per person. All registrations must be received together along with payment to qualify for the discount. Not applicable with any other discount.

REGISTRATION CONFIRMATION
You will receive a confirmation letter in the mail once your registration has been paid in full. Please contact AIST at (724) 776-6040, ext. 642 if you have not received written confirmation two weeks prior to the conference.

CANCELLATION/SUBSTITUTION
If you must cancel, please fax a notice of cancellation to (724) 776-6619 and a refund will be issued. Cancellations received less than two weeks prior to the event are nonrefundable. If you would like to send a substitute, a new registration form must be faxed for that person, indicating the replaced person on the form. Be certain that the membership status of each person is equivalent or note otherwise.

SPONSORED BY
AIST's Ironmaking Technology Committee and Metallurgy — Steelmaking and Casting Technology Committee.

ORGANIZED BY
Joe Poveromo, ArcelorMittal Mines Canada; Jan van der Stel, Corus Research, Development and Technology; Jack Oakey, Praxair Inc.; José H. Noldin, Techno-Logos/ABM; Frank Griscom, HBI Association Ltd.; and Kanji Takeda, JFE Steel Corp.

HBI USER SEMINAR — SHORT COURSE
HBI Association Ltd. (HBIA), in cooperation with AIST, will present a half-day short course on the use of HBI in iron production and steelmaking applications. The seminar will discuss the characteristics of HBI, the use of HBI in BF iron production and EAF and BOF steelmaking applications, the effect of HBI on greenhouse gas emissions, and guidelines for handling, shipping and storing HBI. The course fee is US$100 with Scrap Substitutes and Alternative Ironmaking V conference registration or US$200 without registering for the Scrap Substitutes and Alternative Ironmaking V conference. You may register for this course online at www.aist.org or by using the registration form in the brochure. For more information about HBI and the activities of HBI Association Ltd., please contact HBIA at director@hbia.org or visit www.hbia.org.

SUNDAY, NOVEMBER 2

11 a.m.
HBI User Seminar Registration

1–5 p.m.
HBI User Seminar

3–5 p.m.
Conference Registration

5:15 p.m.
OVERVIEW OF DIRECT REDUCTION AND ALTERNATIVE IRONMAKING PROCESSES AND PRODUCTS
J. Poveromo, ArcelorMittal Mines Canada, and R. Smailer, Metserv Consulting

This symposium covers the development and application of alternative (to the blast furnace) ironmaking processes where the objectives include the following:

- hot metal processes to feed oxygen converters or electric arc furnaces,
- direct reduction processes to feed electric arc furnaces or to produce DRI/HBI to feed blast furnaces, oxygen converters, etc.,
- direct reduction or hot metal processes to process waste oxides from either EAF minimills or fully integrated plants.

Accordingly, in this introductory lecture, we will present an overview of these direct reduction and alternative ironmaking processes and the products they produce.

6–7 p.m.
Reception

MONDAY, NOVEMBER 3

7:30 a.m.
Registration and Continental Breakfast

COMMERCIAL GAS–BASED DIRECT REDUCTION PROCESSES AND PRODUCTS

8:30 a.m.
DIRECT REDUCTION TECHNOLOGY PROGRESS IN ARCELORMITTAL
A. Farhadi, G. Tsvik, J. Farley and J. Vazquez, ArcelorMittal

ArcelorMittal is the world's largest producer of steel and also one of the world's biggest producers/consumers of DRI. ArcelorMittal has a current capacity of 110 million tons of steel and 12 million tons of DRI. Depending on the plant location, different ironmaking technologies are used at ArcelorMittal to produce steel. We have blast furnaces, natural gas–based DRI plants (Midrex and HYL), coal-based rotary kilns and Corex plants. Solid iron units generally are fed to EAF operations, whereas molten iron is fed to converter shops.

9 a.m.
PRESENT HBI PLANT OPERATION AT ORINOCO IRON
R. Whipp, Whipp Technology Inc.

The HBI production in Venezuelan plants is principally utilized for export. One plant, Orinoco Iron, uses the FINMET process and is presently the only HBI plant worldwide operating with iron ore fines for feed in HBI production. The plant has a design capacity of 2 million tonnes/year with four trains.

Technical developments have been made in order to improve operation and to increase plant production capacity following the start-up in 2000. Daily train capacity has been achieved.

The company also operates the Venprecar MIDREX plant, where capacity has been increased above the design of 600,000 tonnes/year, and the HBI product is partially used in an adjacent EAF shop. Most of the HBI production in the two plants is exported.

9:30 a.m.
NUCOR'S SUCCESSFUL RELOCATION AND START-UP OF THE AIR PLANT
R. Dabideen and S. Heraldo, Nu Iron

Nucor purchased the American Iron (AIR) DRI facility in Convent, Louisiana, in August 2004. With high energy cost in North America, Nucor opted to relocate and operate this plant in Trinidad and Tobago. Thirteen ocean-carrying barges and three vessels out of Louisiana were utilized to relocate plant and equipment. A total of 72,281 tons of material were moved. Three of the barges were recognized for breaking the North American rigging record. The first barge landed in March 2005 and the last landed in October 2005.

The project broke ground in May 2005, with commissioning activities starting in June 2006. Production of DRI from the relocated facility started on December 31, 2006, just 19 months after breaking ground. Nucor was able to ramp up to design production rate within one week of starting production and successfully completed the performance test within two weeks of the start-up. This was indeed a remarkable achievement. Midrex, the owners of this process for making DRI, rated this as one of the best plant start-ups.

10 a.m.

DRI – PREMIUM RAW MATERIAL FOR ELECTRIC STEELMAKING

M.T. Guerra and J. Becerra, Tenova HYL; and C. Lizcano Z., Ternium

As a result of the continuous growth in the world's steel production and together with the more demanding quality of steel products, premium scrap has become an expensive and scarce raw material.

DRI permits the production of the most stringent quality steel, due to the absence of contaminants. On the other hand, DRI can easily be continuously fed, eliminating the need for recharging the furnace by opening the roof.

The effect on the EAF performance when using different percentages of DRI with different qualities will be analyzed and presented, stressing the advantages of high-carbon DRI as a scrap substitute.

10:30 a.m.
Break

NOVEL IRONMAKING, CO_2 MITIGATION

10:45 a.m.

ROLE OF ALTERNATIVE IRONMAKING PROCESSES FOR CO_2 MITIGATION AND ITS RECENT DEVELOPMENT

K. Takeda, M. Sato, Y. Sawa, N. Ishiwata and H. Hiroha, JFE Steel Corp.

In 2008, the first year of the first commitment period of the Kyoto Protocol, Japanese steel industries have attempted to reduce energy consumption by 10% against the 1990 baseline condition by the voluntary action plan. Metallic charging to a blast furnace is one option of the CO_2 emission reduction. In this paper, typical alternative ironmaking processes, mini-blast furnace, smelting reduction process, gas-based direct reduction and rotary hearth furnace are accessed in terms of CO_2 emission for the metallic iron production. The rotary hearth process has shown relatively lower CO_2 emission than other coal-based processes. Recent progress will be demonstrated for commercialization of the Hi-QIP process, one of the latest technologies of a rotary hearth furnace

11:15 a.m.

DEVELOPMENTS AND EVALUATION OF THE ULCOS BLAST FURNACE PROCESS AT LKAB EXPERIMENTAL BF IN LULEÅ

J. van der Stel, H. Jak, Corus Research, Development and Technology; G. Danloy, CRM; A. Berthelemot, M. Grant, Air Liquide; D. Sert , J. Borlée, ArcelorMittal; V. Dimastromatteo, ILVA; M. Hallin, N. Eklund, LKAB; N. Edberg, L. Sundqvist, B-E. Sköld, MEFOS; R. Lin, A. Feiterna, Saarstahl-Dillingen Hütte; B. Korthas, F. Müller, ThyssenKrupp Steel; and C. Feilmayr, A. Habermann, voestalpine

The development of a Top Gas Recycling Blast Furnace (TGR-BF) process is one of the initiatives from the European consortium of steel companies, ULCOS, to reduce CO_2 emissions. This process is based on the replacement of hot blast by oxygen and the recycling of hot decarbonated top gas into the lower shaft and normal tuyeres.

This paper highlights the main features of this ULCOS blast furnace process, and the expected benefits for CO_2 mitigation. This technology was demonstrated along a 7-week campaign in autumn 2007 by coupling LKAB experimental blast furnace in Lulea to a pilot VPSA unit for CO_2 removal. The preparation and first results of the trials are described.

11:45 a.m.

NOVEL SUSPENSION IRONMAKING TECHNOLOGY WITH LOW ENERGY REQUIREMENT AND CO_2 EMISSION

H.Y. Sohn, M.E. Choi, Y. Zhang and J. Ramos, University of Utah

A new technology for alternate ironmaking based on the direct gaseous reduction of iron ore concentrate is under development, which would reduce energy consumption by nearly 38% of the amount required by the blast furnace and drastically lower environmental pollution, especially CO_2 emission, from the steel industry. The technology is aimed toward the production of iron as a feed to the steelmaking process, eventually replacing the blast furnace. Feasibility of the technology is presented based on the material and energy balances and comprehensive rate measurements using concentrate particles, together with preliminary scale-up test results using a bench-scale test facility.

12:15 p.m.
Lunch

IRONMAKING FOR WASTE OXIDE AND IRON ORE PROCESSING

1:30 p.m.

SUCCESSFUL DEVELOPMENT OF MIDREX® RHF TECHNOLOGIES 40 YEARS FROM CONCEPT TO COMMERCIAL REALITIES

J. McClelland, Midrex Technologies Inc.

Midrex began research in rotary hearth furnace technologies more than 40 years ago in an effort to produce semi-metallic BF feed using iron ore and coal. Since 1990, Midrex has devoted significant resources to further the development of RHF reduction technologies, culminating in successful commercial applications of FASTMET®, FASTMELT® and ITmk3®. In each, iron oxide–bearing materials are mixed with a carbon source, agglomerated, reduced, and refined to produce a high-quality iron for steelmaking.

The success to date includes three commercial plants in operation, three commercial-scale plants under construction, and three additional plants in final contract negotiations. The latest developments for Midrex RHF technologies include a 500,000 tpy ITmk3 plant under construction for SDI in Minnesota (expected start-up 2009).

2 p.m.

IRONMAKING FOR NICHE QUALITY PRODUCTS

C. Bartels-von Varnbüler, M. Lemperle and J. Rachner, Küttner GmbH & Co. KG

Liquid hot metal serves as a base metal for a variety of applications. Steel of different qualities or simply pig iron for foundry use are well-known examples.

In times of exploding costs for coke and quality scrap, hot metal producers look for alternative technologies that can produce liquid hot metal from cheap raw materials available at their location.

The new Oxycup® shaft furnace technology produces liquid hot metal. A smaller lance- and bottom-blown converter and a degassing unit supplies steel to the caster for small production units up to approximately 500,000 tons per year. These quantities are in particular suited for niche products required in changing qualities.

In contrast to other technologies, Oxycup® can process residues like zinc-containing dusts and sludge, e.g., from steel plants, but also iron ore and DRI fines, HBI and even coarse lumps of pit scrap and skulls at the same time. Besides hot metal, the Oxycup® delivers a clean medium-calorific top gas that can be used for power generation.

Reduction of iron oxides contained in ore or residue fines is carried out with the help of cheap carbon fines, e.g., from anthracite, petroleum coke or from coke quenching. Mixed with cement as a binder ,oxides and carbon fines are pressed to self-reducing "C-bricks" that can be charged into the shaft furnace.

The Oxycup® technology, combined with converter, steel degassing and casting, has proved its versatility by successful operating plants in Germany, Mexico and Japan. Coming projects are designed for India, Russia and Indonesia.

2:30 p.m.

DEVELOPMENT OF EAF DUST RECYCLING AND MELTING TECHNOLOGY USING THE COAL-BASED FASMELT® PROCESS

H. Fujimoto, T. Harada, H. Sugitatsu and M. Tateishi, Kobe Steel Ltd.

The accumulation of EAF dust and its disposal have become a serious issue worldwide. Kobe Steel has carried out a process development project, including pilot plant operations at Kakogawa Works in Japan, for about three years. Offering a solution to EAF dust recovery, the FASTMELT® process produces valuable DRI from EAF dust, which contains a high concentration of zinc. Moreover, the DRI can be melted into hot metal using the coal-based FASTMELT® process. This suggests that FASTMELT® could be a solution to produce hot metal from iron ore fines and non-coking coal.

3 p.m.
Break

3:15 p.m.

PAUL WURTH'S TECHNOLOGIES FOR RECYCLING STEELMAKING RESIDUES AND NON-FERROUS METALS

T. Hansmann, P. Fontana and A. Chiappero, Paul Wurth Italia S.p.A

Recycling iron and steelmaking byproducts is becoming a priority for the steel industry, while it is facing fast-increasing prices of the alloying metals (nickel, molybdenum, chromium, etc.).

Thanks to the different engineering backgrounds of the organizations now forming the group, Paul Wurth is in a condition to handle a wide range of technologies for processing metallurgical residues: preparation/agglomeration, pre-reduction in rotary hearth or multiple hearth furnace, smelting furnaces and their combinations.

This broad know-how enables Paul Wurth to evaluate the advantages and limits of each recycling technology and consequently its best field of application.

3:45 p.m.

ON A NEW IRONMAKING PROCESS TO REDUCE ENERGY CONSUMPTION AND PRODUCE HYDROGEN; PRE-REDUCTION OF IRON OXIDE FINES WITH SIMULATED HIGHLY POST-COMBUSTED SMELTER OFFGAS

R. Corbari and R.J. Fruehan, Carnegie Mellon University

The energy, emissions and cost of iron production can be reduced by using high-volatile coals and iron oxide fines in a new proposed ironmaking process. The process combines a unit for charring of coals with an iron bath smelter coupled with a gas-solid pre-reducer. The charring unit, employing high-volatile coals, is aimed to produce hydrogen-rich volatile gas and char. The volatile gas may be used for energetic purposes such as syngas or hydrogen production. The char, enriched in carbon and depleted in volatiles (hydrogen, sulfur), is fed into the smelter, providing energy and reduction for the process. The use of char instead of coal in smelting may increase productivity, post-combustion levels and thus the energy efficiency of the process. The chemical and sensible energy of the post-combusted smelter offgas is then employed to pre-heat and pre-reduce iron ore fines in the pre-reducer. The reduction kinetics of iron oxide fines from hematite to wustite by a CO/CO_2 gas mixture of low reducing potential and moderate temperatures was experimentally studied by thermogravimetry. Results indicate the overall reaction occurs in a two-step scheme where rate-controlling and reduction mechanisms vary with reduction degree and iron oxide properties.

4:15 p.m.
Open Discussion

5:15–7:15 p.m.
Reception

Program at a glance

TUESDAY, NOVEMBER 4

7:30 a.m.
Continental Breakfast

COAL-BASED IRONMAKING TO FEED THE ELECTRIC ARC FURNACE

8:30 a.m.

GREEN PIG IRON, VALE'S SUCCESS EXPERIENCE

J.B. de Araújo Neto, E. Sousa, and F.M. Moraes, Vale; and C.H. Garcia, Ferro Gusa Carajás

Production of scrap substitutes based on non-renewable energy has been a big constrain of virgin iron units producers worldwide. Pig iron production in mini blast furnaces using charcoal produced from reforestation wood as fuel in a economically sustainable manner is one of the biggest challenges posed to Brazilian producers in the northeast region. Ferro Gusa Carajás, a Vale company — with its 80,000 ha, of which 34,000 ha is reforested eucalyptus, 11 carbonization plants, 2 mini blast furnaces and the whole logistic infrastructure necessary — has shown that production of green pig iron is economically possible. The main features and figures of this successful project will be shown.

9 a.m.

"A LONG ROAD TO LIQUID GOLD… THE SAGA CONTINUES"

D. Bednarz, Steel Dynamics Inc.

The Iron Dynamics Division of Steel Dynamics Inc. has been pioneering an effort to produce liquid pig iron from coal-based direct reduced iron. Following an interruption in production in 2001, the plant has been running continuously since the fall of 2003. This presentation will serve as update on the process development.

9:30 a.m.

ISARNA, A NEW SMELTING REDUCTION PROCESS

K. Meijer, Corus;G. Günther, Saarstahl; J. Borlee, ArcelorMittal; A. Hirsch, TSK; F. Weisgerber, Paul Wurth; W. Küttner, Küttner; R. van Oudenallen, Danieli Corus; and R. Dry, HIsmelt

As part of the ULCOS (Ultra Low CO_2 Steelmaking) project, the Isarna smelting reduction process will be tested at pilot scale. The Isarna process builds on existing technologies but is further optimized for minimum CO_2 emissions and "storability" of the offgases during the ULCOS project. Isarna is a combination of an iron ore melting cyclone, a bath smelter based on HIsmelt technology and a coal pyrolysis step. The offgas of the process will consist mainly of CO_2 because of the absence of nitrogen and full combustion of the process gas. In the first phase of the ULCOS project, more than 200 potential routes from raw material to hot rolled coil were compared and evaluated. Isarna was one of the technologies selected for further development because of the excellent fit with CO_2 capture and storage and because of the lower carbon usage, 20% lower than the reference blast furnace case.

The combination of the melting cyclone and the bath smelter will be tested in a purpose-built pilot plant. This plant is presently under construction at the site of Saarstahl in Völklingen, Germany.

10 a.m.
Break

ALTERNATIVE IRONMAKING AND STEELMAKING ROUTES

10:15 a.m.

THE BENEFITS OF CONTINUOUS STEELMAKING, THE HATCH CRISP ALTERNATIVE

F. Atkinson, J. Bolen, S. Broek and Y. Gordon, Hatch

The successful pilot testing of the Hatch Continuous Reduced Iron Steelmaking Process (CRISP) in August 2007 and April 2008 confirmed the underlying metallurgical concepts with continuous operation and a direct reduced iron feed, and also identified further operational and quality benefits. The tests were conducted at the MEFOS Research Institute in Sweden.

These benefits are summarized together with the results of the more detailed plant design and updated capital and operating costs.

The cycle costs from iron ore to cast product are compared to those of plants with conventional technologies. Potential applications of the CRISP technology are outlined.

10:45 a.m.

DIRECT REDUCTION OF IRON ORE FINES BASED ON CIRCOFER® AND ITS PRODUCT VERSATALITY

K. Förster, A. Orth and J-P. Nepper, Outotec GmbH

Outotec has been developing circulating fluidized bed (CFB) processes for more than 50 years. One CFB application is the direct reduction of iron ore fines using coal - the Circofer® process.

This paper will give an overview of the process principles. Circofer® uses ore fines, and a wide range of coals is suitable for the process, with the advantage of avoiding agglomeration like sintering or pelletizing and cokemaking. The closed gas circuit fully utilizes the coal volatiles for the process. Combining Circofer® with an electric arc furnace to produce crude steel represents an economical attractive process and results in a significant CO_2 reduction compared to the conventional blast furnace and BOF route.

Test works in Outotec's 700-mm CFB test facility with different raw materials and a variety of coals have been performed. This paper summarizes the latest test results with achieved metallization degrees up to 80% in a single step.

Furthermore, an overview of the versatility of the direct reduced iron (DRI) from the Circofer® process as feed material for several subsequent processes (as, for example, HIsmelt or EAF) and its advantages will be outlined.

11:15 a.m.

TECNORED INDUSTRIAL PLANT — FACTS AND FIGURES

J.H. Noldin, I. Cox, M. Contrucci, Tecno-Logos S/A; and J.C. D'Abreu, PUC-Rio

The first industrial plant of the Tecnored coal-based ironmaking technology, also known as IDP, was built in Brazil to demonstrate the feasibility of the process from technical, economical and environmental perspectives. This paper will present the main features of this plant, also showing first-hand operational results and the future plans concerning this novel ironmaking technology.

11:45 a.m.
Open Discussion

12:15 p.m.
Lunch

LARGE SCALE ALTERNATIVE COAL-BASED IRONMAKING

1:30 p.m.

DEVELOPMENT AND CURRENT STATUS OF THE COREX® PROCESS WITH SPECIAL FOCUS ON COREX BAOSTEEL

K. Siuka, J. Schenk, C. Böhm, Siemens VAI Metals Technologies GmbH & Co.

With the start-up of the COREX® C-3000 plant with an annual capacity of 1.5 million t hot metal by Baosteel, China, a new milestone for the COREX technology could be reached. This module represents the up-scaling and the experiences made with the COREX plants in operation at Mittal Steel South Africa, at Jindal, India, and the two FINEX® plants at POSCO, Korea. Considerable changes in the raw material sector (iron ores, price of coke, coking coal and steam coal, etc.) and the general increase of energy cost (natural gas, electric power, etc.), in combination with the positive experiences during the operation and strictly enforced environmental laws, make it worthwhile to carefully evaluate the COREX technology in comparison with traditional blast furnace technology. In addition to the first COREX Plant C-3000 in operation, Baosteel signed the contract for the second COREX Plant C-3000 in December 2007.

The main focus of this presentation is laid on developments of the COREX technology, giving inside views about the operating COREX plants at Mittal Steel South Africa, Jindal South West Steel, especially the COREX plant C-3000 of Baosteel, the COREX plants under construction (Essar Steel), new technological developments and factors endeavoring the COREX technology. In addition, new brownfield ironmaking concepts only possible with the COREX and/or the FINEX process will be depicted.

2 p.m.

HISMELT PLANT UPDATE

R. Dry and N. Goodman, HIsmelt Corp.

The first 0.8 Mt/a HIsmelt plant in Kwinana, Western Australia, has been in a ramp-up phase for the past two years (as part of a total 3-year planned ramp-up). Although many operational and ancillary-related issues have challenged the production team, their perseverance is now paying off.

A major offgas-related process bottleneck has recently been eliminated. It has become possible (for the first time) to push the smelter closer to its design operating rate, and the results are highly encouraging, with operation at 75–80% of name-plate capacity being demonstrated. New bottlenecks are still being exposed as production increases, and the immediate focus is to achieve sustained production at these levels for longer periods.

The next phase (to be implemented in 2008) involves coupling the smelter to the iron ore preheater to increase productivity from the present 80% to 100% and achieve full name-plate production.

2:30 p.m.

AN UPDATE ON FINEX® PLANT OPERATIONS

S. Joo and H. Lee, POSCO

FINEX is a new ironmaking process that is based on the direct use of fine ore and non-coking coal. The key technologies involved are the fluidized-bed reduction of fine iron ore, the hot fine DRI (direct reduced iron) compaction to HCI (hot compacted iron), the briquetting of fine coal, and the melting of HCI into hot metal.

A 1.5 mtpy FINEX commercial plant has been operating at POSCO's Pohang Works since April 2007. The start-up operation was carried out smoothly, and improved gradually over time. Recently, the normal operational performance has been achieved, satisfying target values of production rate, coal consumption, plant availability and hot metal quality.

3 p.m.
Closing Remarks and Adjourn

Scrap Substitutes & Alternative Ironmaking V

November 2–4, 2008
Renaissance Harborplace Hotel
Baltimore, Md.

Early Registration by October 3, 2008:	❑ **Member US$845**	❑ **Nonmember US$995**
Late Registration After October 3, 2008:	❑ **Member US$945**	❑ **Nonmember US$1,095**
Company Discount:	❑ **Yes**	❑ **No**
HBI User Seminar (optional)	❑ **US$100 (with course)**	❑ **US$200 (HBI Seminar only)**
Renew My 2009 AIST Dues:	❑ **US$115**	

Personal Information

Name _____

Name to Appear on Badge (if different than first name) _____

AIST Member No. (required for member rate) _____

Title _____ **Company** _____

❑ **Steel/Metals Production** ❑ **Services to the Industry**

Business Address _____

City _____ **State/Province** _____

ZIP/Postal Code _____ **Country** _____

Phone _____ **Fax** _____

E-mail _____

Payment Information

❑ **Check:** Payable to AIST, in U.S. dollars and drawn from a U.S. bank.

Credit Card: ❑ VISA ❑ MC ❑ AMEX

Card Number: |_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|_|

Exp. Date (Required) _____ Authorized Signature:_____

FAX
724.776.6619

MAIL
186 Thorn Hill Road
Warrendale, PA 15086

INTERNET
www.aist.org

2008–2009 Specialty Training Conferences

2008 International Crane Symposium
September 23–26, 2008
Teledom Conference Center, Košice, Slovakia

Modern Maintenance Practices Workshop Specialty Training Conference
October 1–3, 2008
Memphis Marriott, Memphis, Tennessee

Continuous Casting — A Practical Training Seminar
October 14–16, 2008
Radisson Hotel at Star Plaza, Merrillville, Indiana

Safety Conference
October 27–29, 2008
Sheraton Station Square, Pittsburgh, Pa.

Making, Shaping and Treating of Steel: 101
November 9–12, 2008
Radisson Hotel at Star Plaza, Merrillville, Indiana

Process Systems Specialty Training Conference
February 2–5, 2009
Hyatt Jacksonville Riverfront, Jacksonville, Florida

Modern Electric Furnace Steelmaking — A Practical Training Seminar
February 16–20, 2009
Doubletree Hotel Ontario, Ontario, California

Cold Rolling Fundamentals — A Practical Training Seminar
February 22–26, 2009
Hyatt Orlando Airport, Orlando, Florida

Lubrication Manual Seminar
March 16–19, 2009
Birmingham, Alabama

Ladle Refractory Short Course
March 17–18, 2009
Birmingham, Alabama

Hot Flat Rolling Fundamentals — A Practical Training Seminar
March 29–April 2, 2009
Marriott Ann Arbor Ypsilanti at Eagle Crest, Ypsilanti, Michigan

16th Annual Crane Symposium
May 31–June 2, 2009
Sheraton Station Square, Pittsburgh, Pa.

AIST
ASSOCIATION FOR IRON & STEEL TECHNOLOGY
186 Thorn Hill Road
Warrendale, PA 15086 USA