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<th>Room No.</th>
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Session: Cold Sheet Rolling - Improvements in Cold Rolling Technologies

**Solutions for the Production of High-Strength Steels and Thinner Gauges in Cold Rolling**

This paper deals with selected innovations of Primetals supporting a successful production of advanced high-strength steel (AHSS) and thinner gauges. The presented paper will show a historical view of work roll diameter evolution with respect to harder and thinner steels and introduce two new solutions for the production of AHSS: Flex-HI and Hyper UC-Mill. A new roll gap lubrication technology, MQL®, allows the adjustment of oil film thickness independent of the rolling speed. This leads to significant advantages for rolling AHSS. To overcome the risk of unwanted mill vibration, a unique solution to eliminate gauge chatter was developed, which supports high-productivity production of AHSS.

Time: **10:00 am** / Location: **103B**

Speaker: Konrad Krimpelstaetter, Primetals Technologies Austria GmbH

> Back to Top

Session: Ladle & Secondary Refining - RH Degassing Operations

**New RH Installation at thyssenkrupp CSA - Moving to Industry 4.0**

This paper describes the installation and start-up of the second RH degasser at the Rio de Janeiro plant of thyssenkrupp CSA. The new plant is installed as part of the existing RH. The twin solution increases the overall meltshop production in the area of quality plates, especially for deep-drawing grades. With this new equipment, CSA is able to increase degassed grade production with a state-of-the-art asset that has the ultimate technology in operation, safety and automation. The description of the main components and the operational concept gives an overview of the latest in RH plant engineering combined with operational practice.

Time: **10:30 am** / Location: **113A**


> Back to Top

Session: Long Products - Startups & Upgrades

**The State-of-the-Art Rolling Mill for Rails at ARBZ**

The rolling mill for rails and sections installed in the town of Aktobe is the first rail manufacturing operation in Kazakhstan. It represents the current worldwide benchmark of premium rail manufacturing. The rails are pre-certified per GOST standard and, besides saturating the domestic market, are exported to the Russian Federation and CIS countries. In order for rails to have a high-contact fatigue and wear resistance, the rolling mill is equipped with in-line injector dual-phase rail hardening, the most advanced technology available for heavy-duty rails with lengths up to and longer than 120 m.

Time: **10:30** am / Location: **103C**

Speakers: Alberto Lainati, Primetals Technologies; Francesco Toschi, Primetals Technologies

> Back to Top

Session: Ironmaking - Blast Furnace Technology Development & Research I

**Risk and Knowledge Management With Blast Furnace Process Optimization Systems**

As an introduction to expert systems, individual judgement of process conditions and required actions receive support by rule-based decision systems with an incorporated, standardized operation strategy that has been jointly elaborated for the individual furnace. By model-supported analysis of the operational condition, an early detection of undesired deviations allows for safely going closer to the operational limits. By this, improved results regarding blast furnace performance, fuel rates and operational stability can be achieved. This paper shows practical examples of critical operational conditions of the blast furnace and the corrective actions automatically suggested and executed by the expert system.

Time: **11:00 am** / Location: **201B**

Speakers: Dieter Bettinger, Primetals Technologies; Joachim Mauhart, voestalpine; Martin Schaler, Primetals Technologies; Harald Fritschek, Primetals Technologies; Thomas Kronberger, Primetals Technologies

> Back to Top
**Session: Electric Steelmaking - Energy**

**New Solutions for Injection Technology and Automated Taphole Filling to Lower Consumption Figures and Improve Productivity of the EAF**

This paper shows the latest developments for improved productivity and efficiency at the EAF. A new movable Refining Combined Burner (RCB) technology and a revolutionary way of taphole filling will be described in detail. Both technologies can easily be implemented in existing furnaces. The main improvements of the horizontally movable RCB are better cold spot elimination, lower electrode consumption, higher homogenization of the steel bath, improved scrap pre-heating and lower power-on times. The automated taphole-filling device helps to lower power-off times and improves the overall safety due to manless taphole filling operation.

**Time:** 2:00 pm / Location: 114

**Speakers:** Hannes Beile, Primetals Technologies; Jens Apfel, Primetals Technologies

**Session: Ironmaking - Blast Furnace Technology Development & Research II**

**Characterization of Gas Phase Reaction Regime in the Raceway Zone**

Chemical conversion of gaseous and solid carbon carriers takes place in the raceway zone of blast furnaces. During chemical conversion of solid fuels, degassing volatiles react in the gas phase. Thus, solid fuel conversion influences gas phase chemistry. Characteristic numbers and time scales are employed to identify the reaction regime in the raceway, which is supposed to change from turbulent in the vicinity of the tuyere to laminar in the coke bed. The focus of this work is on the characterization of the raceway reaction regime, with special emphasis on the transition within the raceway toward the dense coke bed.

**Time:** 2:00 pm / Location: 201A

**Speakers:** Markus Bösenhofer, TU Wien; Eva-Maria Wartha, TU Wien; Christian Jordan, TU Wien; Michael Harasek, TU Wien; Christoph Feilmayr, voestalpine Stahl GmbH; Franz Hauzenberger, Primetals Technologies Austria GmbH

**Session: Long Products - Rod and Bar Efficiency**

**Highly Efficient Mini-Mills With Innovative Scrap Pre-Heating and Direct Rolling of Long Products**

Production overcapacity, volatile markets and environmental regulations have affected new mini-mill investments. Considerations focus on conversion cost, footprint, product quality requirements and efficiency of the mills. By modularizing mini-mill technology portfolios, suppliers can build customized solutions based on market environment and end product size and quality. The paper will focus on long product mini-mills with up to 450,000 ton per annum capacity and flexible product mix (scrap, direct reduced iron, hot briquetted iron), low conversion cost and small footprint. It will present operational results and detailed overviews of technology implemented in recent projects related to scrap pre-heating, direct rolling, automation and safety.

**Time:** 2:30 pm / Location: 103C

**Speakers:** Jens Apfel, Primetals Technologies; Stefan Fellner, Primetals Technologies Austria GmbH; Joerg Buttler, Primetals Technologies

**Session: Project and Construction Management - Important Lessons for Successful Projects**

**Project of the New No. 2 CRM of Tangshan Dedicated to High-End Markets With the Production of Advanced High-Strength Steels of Automotive Grade**

This paper presents the project of Tangshan's new No. 2 Cold Rolling Mill Complex (pickling line coupled to a tandem cold mill, continuous annealing line and continuous galvanizing line) dedicated to high-end markets such as the automotive. The project included equipment delivery, line start-up and through-process optimization know-how package to bring steel production and plant organization robustness and cover new steel grades, especially advanced high-strength steel. The combination of Primetals Technologies' expertise in equipment, process and know-how, with Tangshan's experience in the steel field brought a quick success.

**Time:** 2:30 pm / Location: 107B
Results From Recent Converter Revamping Projects

Steel industry investments are focused on modernization and upgrade of existing capacities due to production overcapacity, volatile markets and environmental regulations. This paper will review selected projects highlighting the benefits from such upgrades. At Ruukki, SSAB, Finland, three converters have been exchanged, and improvements of the metallurgical process like yield and lining lifetime have been achieved. At ArcelorMittal Temirtau, Kazakhstan, a Vaicon Measurement Manipulator was successfully implemented and a probe taking measurements at the converter is running now without any manual operator interference. The last project presented is the replacement of two BOF converters at ArcelorMittal Dabrova Gornica, Poland.

Time: 3:00 pm / Location: 107B
Speakers: Gerald Wimmer, Primetals Technologies Austria GmbH; Bernhard Voraberger, Primetals Technologies Austria GmbH

Session: Hot Sheet Rolling - Plant Upgrades and New Equipment

New Constructed Hot Strip Mill for TATA Steel Kalinganagar Project in India

Commercial production has been started at the hot strip mill line at Kalinganagar Project, Odisha, India. The hot strip mill line is the latest conventional hot strip line in India and consists of two roughing mill stands, seven finishing mill stands, three downcoilers and a coil conveying system. Nominal annual production is 5.5 million tons of hot coils. The most modern technologies for hot rolling, which include pair-cross crown control with a mill stabilizing device and looper shape meter, are provided for this line.

Time: 3:00 pm / Location: 103A
Speakers: Toshihiro Usugi, Primetals Technologies Japan Ltd.; Sunil Tiwari, Tata Steel Ltd.; Anil Singh, Tata Steel Ltd.

Arvedi ESP Proves Its Flexibility at Rizhao Steel

Rizhao's ESP line 4 was to be located in an existing meltpshop with a smaller ladle size. Instead, line 4 was redirected and had to be fit into a narrow gap between bays, which was originally meant for maintenance and plant access. The measures to allow this and to accept other ladle sizes will be discussed in this paper, as well as an in-line work roll change to be activated at full-line operation without production interruption and production of thicknesses below 0.8 mm. An outlook of next ESP installations featuring production of thick API grades will also be presented.

Time: 3:30 pm / Location: 103A
Speaker: Andreas Jungbauer, Primetals Technologies

Session: Direct Reduced Iron - Plant Design and Operation

Fines Briquetting – Improving the Economics and Closing the Material Loop at Direct Reduction Plants

At direct reduction plants, a significant amount of byproducts are generated as pellet fines, DR sludge and various dusts from material handling. The most economic way to close the material cycle is to agglomerate these byproducts in a fines briquetting plant applying a binder system that allows feeding the briquettes to the reduction shaft. A first-of-its-kind briquetting plant has been installed at voestalpine’s GoWest Midrex plant in Texas. The plant was successfully commissioned in early 2017. A status report will be provided and results including performance impact and economic feasibility on the Midrex operation will be discussed.

Time: 4:00 pm / Location: 204C
Speakers: Alexander Fleischanderl, Primetals Technologies Austria GmbH; Christian Brunner, Primetals Technologies Austria GmbH; Jörg Schwellberger, Primetals Technologies Austria GmbH

> Back to Top
Latest Modernization Developments and Results of Three Recently Modernized Electric Arc Furnaces

For electric arc furnaces, high performance and productivity can be reached by fully utilized equipment and products and with the associated process know-how for a mostly uniform and safer operation. The furnace components, also associated with supporting products, have to be designed for a maximum power input, utilization and safe operation. This paper will show the results of three recently modernized furnaces in Turkey, Russia and Germany. The latest modernization developments lead to increased productivity, decreased conversion costs, limited refractory wear, improved plant availability and lifetime with heavy-duty components, and safety improvements due to higher automation levels.

Time: 10:00 am / Location: 112

Speaker: Patrik Zipp, Primetals Technologies

Operational Results of Highly Productive EAF Ultimate, Including Ramp-Up Curve and Commissioning Timeline

This paper shows the timeline of a recently finished furnace replacement in Europe from a conventional EAF to a high-powered EAF Ultimate. Major milestones of the one-month shutdown period will be shown. Further topics will be raw material flexibility, one-bucket charging, low electric energy consumption, improved chemical power input, and safety improvements thanks to the modern water leakage detection and a shell weighting system from EAF Ultimate installations all around the world.

Time: 10:30 am / Location: 112

Speakers: Hannes Beile, Primetals Technologies; Jens Apfel, Primetals Technologies; Michel Hein, Primetals Technologies

Design Considerations for Automatic Transfer Schemes in Industrial Plants

Power system reliability is an important factor in industrial plants. Automatic transfer schemes are typically implemented to ensure continuity of service for critical loads. In the event of an interruption, service is restored quickly or immediately by transferring onto an alternate source. This paper discusses the various considerations to be taken into account while designing different types of transfer schemes. It also presents a vendor agnostic algorithm for a Main-Tie-Main auto transfer scheme, which can then be adapted to different systems. Recommendations are presented to help engineers select cost-effective and technically sound solutions for their systems.

Time: 10:00 am / Location: 118C

Speakers: Poojit Lingam, Primetals Technologies; Anil Kanagala, Primetals Technologies; Visvesvaran Subramanian, Primetals Technologies USA LLC

General Design Considerations for Low-Voltage Power Distribution Infrastructure for Steel Plants

Low-voltage infrastructure forms an important interface between the process loads and plant infrastructure. Most downtimes in steel plants are reported due to improper designs of low-voltage systems. An optimal design of low-voltage power distribution can significantly improve productivity of a plant. This paper focuses on the aspects of design for low-voltage equipment selection based on safety, process requirements and electrical design criteria. Factors such as loading, short circuit, power factor, harmonics, grounding, protection, cable sizing and connections, and arc flash considerations will be addressed in low-voltage system design.

Time: 10:30 am / Location: 118C

Speakers: Ramesh Khajjayam, Primetals Technologies USA LLC; Hiranya Pathak, Primetals Technologies; Poojit Lingam, Primetals Technologies
The Handling of Coils, Rolls and Slabs in the Steel Mill Environment

The purpose of this paper is to serve as a guide in determining the best tool to use when handling various objects in the steel mill. This is based on constraints and issues as they arise. Included is a study based on facts such as headroom, gripping strength and aisle constraints. Information on handling, coils, rolls and slabs will be presented, along with safety information.

Time: 10:00 am / Location: 105A
Speaker: John Novak, Primetals Technologies

Dry Slag Granulation – The Future Way to Granulate Blast Furnace Slag

The majority of blast furnace slag has been utilized as cement clinker additive, applying the traditional wet granulation process. Although well proven, disadvantages include the inability to recover the enthalpy of 1.5 GJ per ton of slag, process water consumption and odor problems. A new dry slag granulation (DSG) process has been developed to allow heat recovery. An industrial prototype was installed at voestalpine with a 2-ton-per-minute liquid slag capacity. Since June 2017, trial campaigns have been performed. The paper will discuss trial results, provide a status report, and give an economic outlook for the DSG process.

Time: 11:00 am / Location: 203B
Speakers: Alexander Fleischanderl, Primetals Technologies Austria GmbH; Thomas Fenzl, Primetals Technologies Austria GmbH

The Compact Continuous Cold Rolling System for Medium-Scale Production

The facility characteristics of a compact continuous cold rolling system for medium-scale production are roughly categorized into equipment configuration and control method. The features of the equipment configuration are very short accumulated strip length for welding time and adopting an in-house improved MSW for the welding device with normal rolling reduction. The features of the control method are extremely low-speed rolling and continuous one-way rolling with using coil circulation. A pilot plant was constructed for verifying mentioned features and a concept of the compact continuous cold rolling system was confirmed by welding and rolling test.

Time: 11:00 am / Location: 103B
Speakers: Takehiko Saito, Primetals Technologies Japan Ltd.; Shin’ichi Yasunari, Primetals Technologies Japan Ltd.; Hajime Higuchi, Primetals Technologies Japan Ltd.; Satoshi Hattori, Hitachi Ltd.

Thick Strip Cutting and Welding With High-Power Solid-State Laser: Technology Breakthrough

Steel strip manufacturing is ever reinventing itself, proposing new grades made to tackle the technical limitations of production systems. Primetals Technologies breaks through strip welding by expanding the welder LW21L “Asolid” technology used on low gauges for high-end market such as automotive continuous annealing line/continuous galvanizing line. Addressing the usual drawbacks in maintenance, operation and safety of current welding systems based on mechanical cutting and CO2 laser welding, the LW21H Asolid technology processes thicker strips up to 7 mm with solid-state laser cutting and welding. This new welder is brought to reality through a scale 1-to-1 pilot developed, manufactured and tested in Primetals Technologies workshop.

Time: 11:00 am / Location: 104B
Speakers: Thomas Vallée, Primetals Technologies; Takahiro Yagi, Primetals Technologies Japan Ltd.; Sébastien Maillard, Primetals Technologies; Stanislas Mauuary, Primetals Technologies; Shinichi Kaga, Primetals Technologies Japan Ltd.

Boosting Stainless Steel Production – Recent Process and Equipment Upgrades

A new 95-metric-ton argon oxygen decarburization (AOD) converter and dedusting system has enabled Acroni, a Slovenian steel producer, to increase production of stainless steel niche products and lower specific production costs. Other state-of-
the-art technologies have been installed, such as a process automation system. A vibration damping system reduces vibrations caused by the injection process, leading to reduced wear and maintenance costs. In addition to the reference project, an outlook covering developments for stainless steel production will be presented, including automatic suspension systems, combination of AOD with vacuum treatment, and solutions for recycling slag and dust from stainless steel production.

**Time:** 2:00 pm / **Location:** 203A

**Speakers:** Gerald Wimmer, Primetals Technologies Austria GmbH; Bernhard Voraberger, Primetals Technologies Austria GmbH; Krzysztof Pastucha, Primetals Technologies Austria GmbH

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**Session:** Electrical Applications - Drives and Motors

**Execution Model for Modernizing Protection Schemes for Industrial Power Distribution Systems**

Power system infrastructure in steel mills is at a state where a sweeping change is required to upgrade and modernize. Protection systems in particular are of great importance to improve the safety and reliability of such systems. Upgrading protection is no minor task, given that the steel mills today run harder and longer in order to provide the best value to their customers. A comprehensive execution plan along with an illustrative executed project is provided to upgrade protection infrastructure from decades old technology to the latest microprocessor-based technology. The paper concludes with lessons learned, trade-offs, improvements and recommendations.

**Time:** 2:00 pm / **Location:** 118C

**Speakers:** Anil Kanagala, Primetals Technologies; Visvesvaran Subramanian, Primetals Technologies USA LLC

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**Optimized Redundancy Using a Special Transformer Design for a Swing Unit to Feed Dirty and Clean Bus Loads at Different Voltages**

Steel mill loads are categorized primarily as dirty bus and clean bus loads based on their power quality properties. These loads are traditionally connected to separate buses fed from their own dedicated transformers. This paper presents a transformer design with special windings and switchover functionality to feed either clean or dirty bus loads with the same transformer. The proposed design provides an optimal solution for spare unit requirement without compromising system redundancy. The paper discusses the evaluation of economic and system requirements to implement such a solution.

**Time:** 2:30 pm / **Location:** 118C

**Speakers:** Hiranya Pathak, Primetals Technologies; Ramesh Khajjayam, Primetals Technologies USA LLC

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**Session:** Lubrication & Hydraulics - Proper Lubricant Choice and Fluid Maintenance - Critical for your Mill’s Uptime

**Managing Water Contamination in Hot Rolling Mills to Improve Productivity**

*Co-Authored with Exxon Mobil*

Managing water contamination in lubricants is a challenge for many steel mill operators today. Excessive water ingestion into lubricants is inevitable in steel mill environments and can lead to accelerated rust, corrosion and wear, as well as lubricant degradation. Left unchecked, these factors contribute to component failure and unscheduled downtime, draining mill productivity. This paper will draw on extensive field experience and laboratory results to explain the interactions of water contamination with mill lubrication systems and grease. The paper will also identify lubrication best practices and technologies to help manage water contamination and improve equipment productivity.

**Time:** 2:00 pm / **Location:** 118A

**Speaker:** Toby Hlade, ExxonMobil Fuels and Lubricants Co.; Tom Wojtkowski, Primetals Technologies USA LLC; Timothy Hurley

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**Session:** Cold Sheet Rolling - Cold Rolled Product Processing Improvements

**U. S. Steel - Great Lakes Works No. 5 Continuous Pickle Line (CPL) Revamp With iBox Pickling Technology**

Effectively removing oxide scale from hot-rolled strip surfaces is important when producing cold-rolled substrate for automotive exposed critical product. The U. S. Steel - Great Lakes Works No. 5 continuous pickle line (CPL) has operated since the early 1990s with four steel rubber-lined tanks and immersion heaters at its core, and a series of dams and weirs to recirculate the acid. After more than 20 years, it was necessary to revamp the line. The new installation at Great Lakes Works
brought many technological enhancements, including iBox Pickling Technology, polypropylene tanks and an acid concentration control system.

Time: 3:30 pm / Location: 103B

Speakers: Ernesto Serrano, United States Steel Corporation; Dan Cerrone, United States Steel Corporation; Richard Kritikos, United States Steel Corporation; Takafumi Nakaya, Primetals Technologies Japan Ltd.; Kosei Tsuji, Primetals Technologies Japan Ltd.; Gerald Hayostek, Primetals Technologies USA LLC; Frank Beddings, Primetals Technologies

Session: Hot Sheet Rolling - Slab Rolling Developments

**Mill Stabilizing Device for Reduction of Impact Force, Mill Vibration and Strip Steering Instability in Hot Rolling**

A mill stabilizing device has been developed to reduce impact force, mill vibration and strip steering instability, which are amplified at harder and thinner hot-rolled strip. The device consists of hydraulic cylinders, equipped with damping orifices and chamber, installed between the roll chocks and the mill housing. These cylinders eliminate the clearances between roll chocks and housing and provide a damping effect. The device can be installed in new facilities, as well as added to existing mill stands. The results of reduction of impact forces, mill vibration and strip steering instability are confirmed in an actual production line.

Time: 2:30 pm / Location: 103A

Speaker: Tsutomu Tsutsui, Primetals Technologies Japan Ltd.

Session: Hot Sheet Rolling - Strip Surface Monitoring and Management

**Work Roll Lubrication and Cooling Package for Hot Strip Mills to Produce High-Quality Steel**

The combination of anti-peeling strip/roll gap cooling, roll gap lubrication and powerful exit side work roll cooling systems reduces work roll temperature. This results in a thinner oxide layer on the roll surface with less risk for work roll peeling and reduced roll wear. Lubrication inside the roll gap minimizes friction, thereby enabling rolling force reduction of up to 20% and more. This paper focuses on a technology package of a recently developed and optimized solution consisting of an advanced and reliable work roll lubrication combined with a new (low-OPEX) work roll cooling and anti-peeling sprays.

Time: 4:00 pm / Location: 103A

Speaker: Konrad Krimpelstaetter, Primetals Technologies Austria GmbH