



# **Refractory Technology**

# Applications, Wear Mechanism and Failures

26 - 29 November 2023 Cologne | Germany

# TARGET GROUP

Maintenance and operating personnel, supervisors responsible for plant and unit operations, and managers responsible for decisions on refractory problems will learn about new materials and installation methods. Refractory installers, third party inspectors and contract maintenance personnel will particularly benefit from detailed discussions on new installation techniques and refractory materials.

### **DIRECTED BY**

Dr. Andreas Buhr, Frankfurt

### **REGISTRATION FEE / REMARKS**

EUR 1.090,00\* registration fee VAT-free plus EUR 345,00 conference package (total EUR 1.435,00\*)

EUR 1.290,00 registration fee VAT-free plus EUR 345,00 conference package (total EUR 1.635,00)

\* for employees of member companies and individual members of the Steel Institute VDEh, and for scientific staff of universities

The conference package includes food and beverages during the seminar (incl. 19 % VAT).

A free withdrawal from the seminar is possible until 2 weeks prior to the start. Then, 25% of the seminar fee must be paid.

The total registration amount will be charged for no show or cancellation from the first day of the event. The participant resp. his company also has to bear the cancellation costs of the seminar hotel.

Note: Both during lectures and discussions, as well as in the breaks of the seminar, our guidelines on adherence to cartel-law regulations shall be followed.



### CONTENT

- Steel manufacturing process
- General overview of wear mechanisms and methods for examination of the refractory material after use
- Refractory lining and wear mechanism of blast furnace, taphole, and runners
- Refractory materials for direct reduction plants
- Process conditions affecting the refractory lining life and the development of refractory materials technology in oxygen blowing converters
- Steel Teeming Ladle: ladle metallurgical treatment, refractory stress, materials and lining concepts
- Refractory lining and wear of AC and DC furnaces
- Economics in refractory usage
- Challenges and solutions for continuous casting refractories in consideration of clean steel, automation and economy
- Teamwork on failure case studies

### ORGANISATION

Stahl-Akademie / Steel Academy • Stahlinstitut VDEh Sohnstraße 65 • 40237 Düsseldorf Fon +49 (0)211 6707-458 training@vdeh.de, www.stahl-akademie.de

# VENUE / SEMINAR HOTEL

Stadthotel am Römerturm Sankt-Apern-Straße 32 50667 Köln – Germany

The Steel Academy will automatically make a room booking for the participants at the Stadthotel am Römerturm from 26 to 29 November 2023 for a special rate of EUR 119 /night incl. breakfast. The hotel room bill will be settled by you upon departure. Please advice at registration, if you do not need a reservation or whether you would like to stay longer in the hotel. In case of cancellation the participant resp. his company has to bear the hotel cancellation costs.

8:30



#### Sunday, November 26

#### 16:00 Introduction Andreas Buhr

Participants can present their failure cases and the according information material, so that they can be included in the team work on failure cases

- 16:30 **Steel Manufacturing Process** Andreas Buhr
- 17:30 **GENERAL OVERVIEW of Wear Mechanisms, Methods** for Examination of the Refractory Material after Use Annika Mertke

Chemistry, physics, mineralogy, procedure and evaluation: wear mechanisms, types of damages, description of optional research methods to examine the wear mechanism, typical failures of refractory material after the operational application, evaluation of the samples

19:00 Common Dinner

#### Monday, November 27

8:30 **Refractory Lining and Wear Mechanism of the BLAST FURNACE, Taphole, and Runners** Tobias Broch (via TEAMS)

> Lining concepts considering furnace dimensions, cooling and investment costs. Refractories for furnace shaft and hearth, wear mechanism. Intermediate repair techniques to extend furnace campaign. Development of tapping technique, requirements on taphole mixes and materials used. Performance criteria on lab and practical scale

- 10:30 Coffee Break
- 11:00 Refractory materials for direct reduction plants Jens Sperber Refractory lining | Use of hydrogen in DRI plants

- 11:45 **TEAM WORK – Introduction** Andreas Buhr
- 12:30 Common Lunch
- 13:30 **TEAM WORK – Failure Case Studies**
- Coffee Break 15:00
- **Process Conditions and Factors affecting the Lining** 15:30 Life and the Development of Refractory Materials Technology in OXYGEN BLOWING CONVERTERS

Michael Berger and Jochen Schlüter

Development of LD process, combined blowing process, use of sublance, purpose of bottom stirring, re-blowing/ direct tapping. Charge materials: hot metal; scrap; fluxes/additives. Development in the refractory materials sector, trends and philosophies. Process models and process sequences. Wear mechanism, development and adaptation of lining concepts, counteractions in the refractory materials area and detection of wear. Maintenance and care (until 18:30, incl. short break)

19:00 Common Dinner

#### **Tuesday, November 28**

- STEEL TEEMING LADLE: Metallurgical Treatments, Refractory Materials, Lining Concepts, Refractory Wear and CO<sub>2</sub> footprint Hans Schröter and Andreas Viertauer Metallurgical tasks and equipment, Slag chemistry vs. Steelgrades, Lining Concepts, Purging, "Problem Areas" 10:00 Coffee Break 10:30 STEEL TEEMING LADLE, Part II Andreas Viertauer and Hans Schröter "Horror Cabinet" and measures 12:00 Common Lunch 13:00 TEAM WORK – Failure Case Studies 14:30 Coffee Break 15:00 Lining and Wear of the ELECTRIC ARC FURNACE Leandro Schöttler Influences on the wear, comparison AC and DC furnaces, different kinds of lining, relining hearth and sidewalls between the heats 16:30 short break 16:45 ECONOMICS in Refractory Usage Rinus Siebring Including Teamwork 19:30 Common Dinner Wednesday, November 29 **Challenges and Solutions for CONTINUOUS CASTING** Refractories in Consideration of Clean Steel / Automation and Economy Sven Karrasch and Georg Krumpel Exchangable nozzles, ladle shrouds, subentry nozzles, stopper and tundish lining. Process- and quality- affecting factors. Re-oxidation of the steel. Steel flow in the tundish and in the mould. Damage of the casting system. Optimization of the lining. Automation and economy. Influence of the refractory material on the product quality. Recycling of refractory
- 10:30 Coffee Break

8:30

#### 11:00 Inspection of Refractory Lining by Means of 3D-Laserprofile Measurement Rolf Lamm

- 12:00 Common Lunch
- 13:00 Discussion of Teamwork: **Results on Failure Case Studies** Andreas Buhr
- 15:00 Closing Remarks / Discussion

SPEAKERS: Dipl.-Ing. Michael Berger, RHI Magnesita, Wien Tobias Broch, Iron Making & Refractory Consultant, Duisburg Dr. rer. nat. Andreas Buhr, Almatis GmbH, Frankfurt = Dipl.-Ing. Sven Karrasch, thyssenkrupp Steel Europe AG, Duisburg = Georg Krumpel, RHI Magnesita, Leoben = Dipl.-Ing. Rolf Lamm, Minteq International GmbH, Duisburg = Dr.-Ing. Annika Mertke, Salzgitter Flachstahl GmbH, Salzgitter = Dipl.-Ing. Jochen Schlüter, ehem. SMS group, Düsseldorf = Dipl.-Ing. Leandro Schöttler, Deutsche Edelstahlwerke GmbH, Siegen = Dipl.-Ing. Hans-Christian Schröter, Schröter GmbH, Blomberg 
Ir. Rinus Siebring, Tata Steel Research and Development, IJmuiden 
Jens Sperber, STEULER - KCH GmbH, Höhr-Grenzhausen Ing. Andreas Viertauer, Primetals Technologies Austria GmbH, Linz