

Metallurgy



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Iron Ores

Chairman:

Dr.-Ing. Hans Bodo Längen

Content:

- Crash course: Materials chemistry
- Blast furnace layout
- Resources, types and characteristics of iron ores
- Agglomeration of fines: Sintering and pelletizing
- Cokemaking and requirements on coke
- Chemical and physical processes in the blast furnace
- Application of reducing agents
- Blast furnace performance

Cokemaking

Chairman:

Peter Liszio / Viktor Stiskala

Content:

- Production of iron and steel
- Requirements on coke for the blast furnace process
- Coal formation, mining and beneficiation
- Coal quality / Coal blending
- Coal to coke transformation / Coke quality
- Coke oven machine management
- Battery heating / Coke quenching
- Coke oven life prolongation
- Shut down principles
- Outlook – Future aspects of coke making

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Ironmaking Basic

Chairman:

Prof. Dr.-Ing. Dieter Senk / Prof. Dr.-Ing. Peter Schmöle

Content:

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Ironmaking Advanced

Chairman:

Prof. Dr.-Ing. Dieter Senk / Prof. Dr.-Ing. Peter Schmöle

Content:

- Operational practices and challenges
- Hearth and deadman dynamics
- Modelling and simulation
- Injection of carbon-hydrogen carriers into the BF
- Various BF operation modes worldwide
- Energy network in integrated iron and steel works
- Quality and use of blast furnace slags
- Environmental protection
- Direct reduction and hydrogen-based reduction



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Oxygen Steelmaking

Chairman:

Prof. Dr.-Ing. Karl-Heinz Spitzer / Dr.-Ing. Jochen Schlüter

Content:

- Design, construction and types of oxygen converters
- Thermodynamic and kinetic basics in the converter process
- Tramp elements
- Hot-Metal pretreatment
- Computational fluid dynamics in the converter
- Chemical reactions kinetics
- Mass balance and heat balance
- Converter process modelling
- Chemical compositions and qualities of iron ores
- Comparison of different converter operation practices



Secondary Metallurgy of Steel

Chairman:

Dr.-Ing. Helmut Lachmund



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Content:

- Overview: Tasks of modern secondary metallurgy
- Requirements of materials technology to metallurgy
- Chemistry crash course: How to read phase diagrams
- Thermodynamic and kinetics for secondary metallurgy
- Fluid dynamics in the ladle
- Kinetics of special reactions in secondary metallurgy
- Deoxidation | Calcium metallurgy
- Metallurgy of the ladle furnace, of ladle tank degassing, of RH degassing, of VOD and AOD process
- Special melting processes, especially ESU

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Hydrogen-based Reduction of Iron Ores

Chairman:

Dr.-Ing. Hans Bodo Lünen

Content:

- CO₂-emissions and their mitigation in the steel industry
- History, developments and processes of direct reduction
- Thermodynamics and kinetics of hydrogen-based reduction
- Injection of carbon-hydrogen carriers into the blast furnace
- Iron ores for hydrogen-based direct reduction
- Hydrogen-based direct reduction with Midrex
- Hydrogen-based direct reduction with HyL/Energiron
- Steelmaking in the EAF or in the SAF plus converter?
- Refractory material for DR plants / Hydrogen and refractories
- Hydrogen-based direct steelmaking with hydrogen plasma



Electrical Engineering of Arc Furnaces

Chairman:

Prof. Dr.-Ing. Klaus Krüger

Content:

Role and importance of the EAF in hydrogen concepts / Physics of furnace arcs / Equivalent circuit diagram of AC-furnaces / Short circuit and operating reactance / Circle diagram of AC-furnaces / Design of the high-current system for AC-furnaces / Electrical layout of AC-furnaces / Energy balance of the EAF / Melting of DRI and HBI in the EAF / Energetic modelling of the EAF process / Closed loop power control of AC-furnaces / Power supply for Electric Arc Furnaces / Electric principles of DC-furnaces / Which one is better? Comparison AC - DC



Continuous Casting of Steel

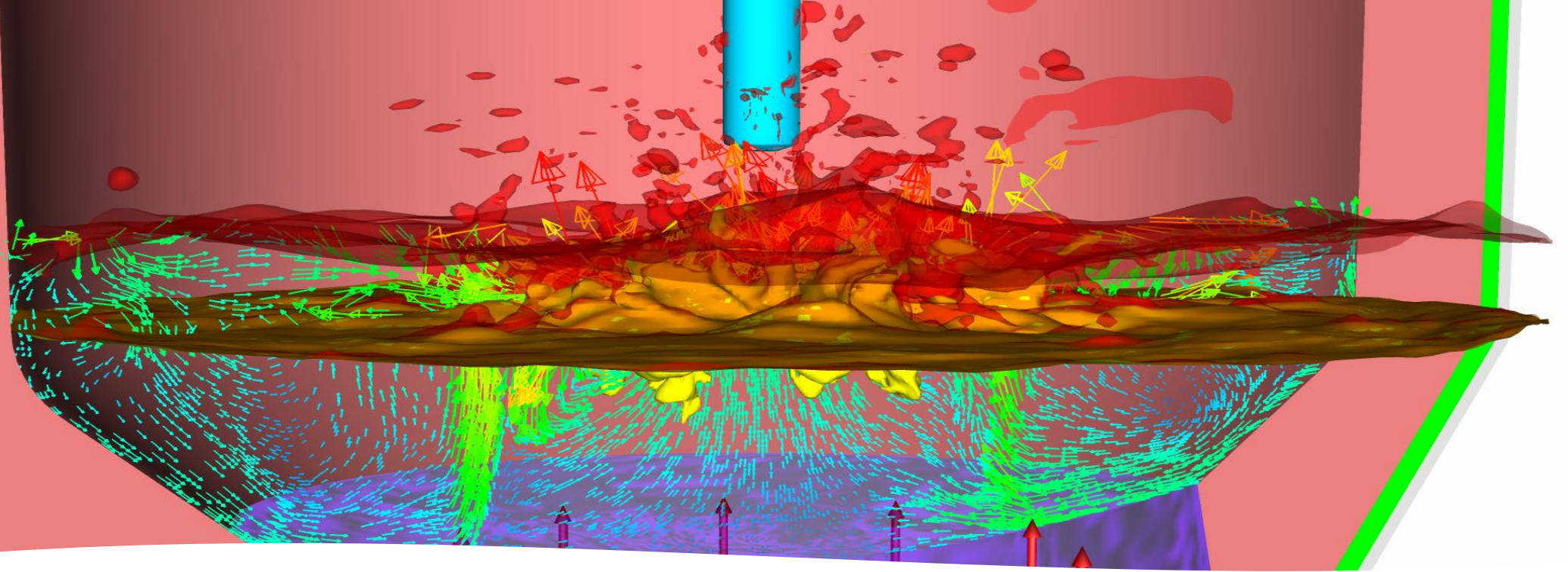
Practical and Scientific Approaches

Chairman:

Professor Dr.-Ing. Dieter Senk

Content:

- Fundamentals on steel solidification
- Heat transfer in continuous casting
- Cooling systems
- Shell growth
- Development of real solidification structures
- Fluid flow in mold and SEN
- Strand guiding; mechanical stress and strain
- Performance of casting flux in the mold
- Surface defects
- Coupling of casting and hot rolling



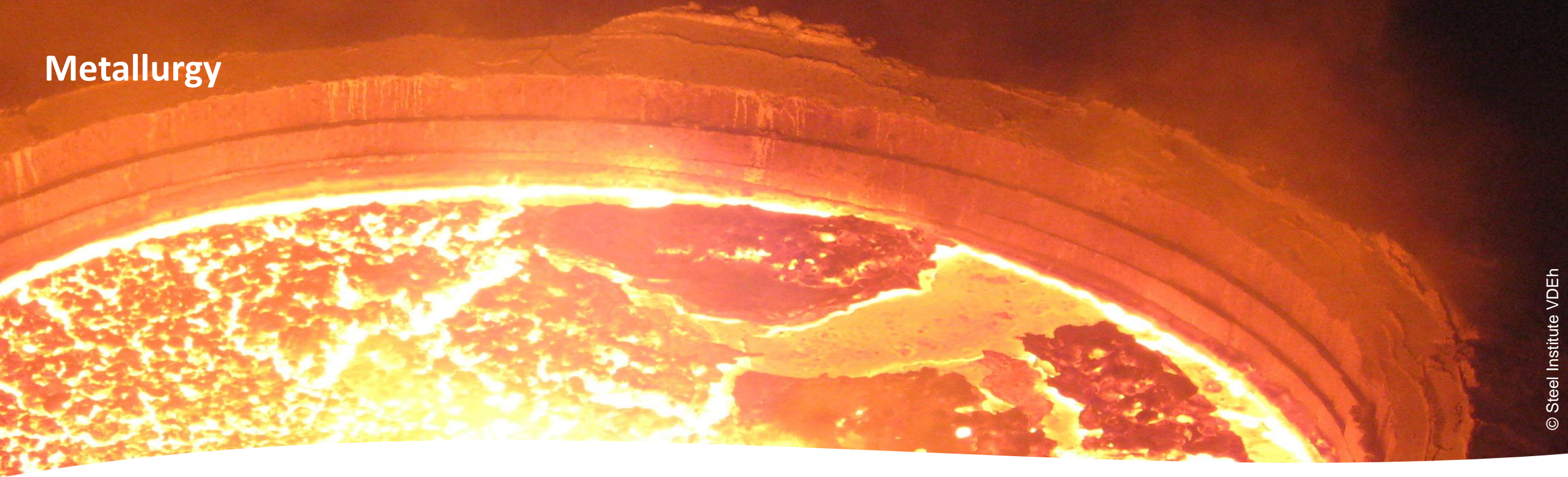
Computational Fluid Dynamics in Metallurgy

Chairman:

Prof. Dr.-Ing. Hans-Jürgen Odenthal

Content:

- CFD with respect to metallurgical applications
- Numerical methods – Equations, models, solvers
- Turbulence modelling: Fundamentals and hybrid RANS-LES
- Introduction to magneto-hydrodynamics
- Combustion modelling in CFD simulations
- Simulation of solidification multiphase flows
- Practical demonstration of Eulerian and Lagrangian
- Accuracy of CFD
- Inert gas stirring in a steel ladle – Modelling and results of a CFD benchmark



Refractory Technology

Refractory Materials and Slags in Metallurgy

Chairman:

Dr. Patrick Tassot / Dr.-Ing. Helmut Lachmund

Content:

- Basics on chemical and mineralogical composition
- Testing and evaluation
- Synthetic alumina raw material | Insulating materials | Monolithics | Lime- and dolomite products | Basic bricks
- Machines for processing and delivering
- Blast furnace process and slags
- Oxygen steel making process and slags
- Secondary metallurgy and slags
- Lime and dolomite

Refractory Technology

Applications, Wear Mechanism and Failures

Chairman:

Dr. Andreas Buhr

Content:

- Steel manufacturing process
- General overview of wear mechanisms
- Economics in refractory usage
- Failure case studies
- Refractory lining concepts of the following aggregates:
Blast furnace, tap hole and runners, oxygen blowing converter, AC and DC electric arc furnaces, steel teeming ladle, continuous casting machine

Steel Ladle Lining

Chairman:

Dr. Andreas Buhr

Content:

- Trends in clean steel technology and steel ladle lining
- Demands on refractories for secondary metallurgy
- Improvements of the steel ladle linings
- Refractory lining for varying operating conditions
- Thermal efficiency of teeming ladles
- Steel ladle lining for flat steel production
- Monolithic lining in a 3-converter-shop
- Purging plugs in steel ladles
- Teamwork: Optimization of economics in refractories
- Refractory panels on current technical subjects

Stainless Steels

Chairman:

Prof. Dr.-Ing. Thomas Ladwein

Content:

- Production routes and history of stainless steels
- Basic metallurgy of stainless steels
- Duplex steels
- Standards and codes, designations
- Groups of stainless steel and their properties
- Chemical resistance of stainless steels
- Manufacturing of stainless steels
- Surface properties
- Applications of stainless steels