Stahl | Steel Institute VDEh

Steel Academy

Online Seminar / Live Stream

Hydrogen-based Reduction of Iron Ores

6 - 7 October 2020
8.30 a.m. till 1 p.m. CET

Chairmen

Dr.-Ing. Hans Bodo Lüngen / Prof. Dr.-Ing. Johannes Schenk

Online Seminar Organisation

Technical quality:
The Steel Academy attaches great importance to the audio-visual quality of its online seminars. This seminar will be broad-cast as a live-stream from Steel Academy's film studio in Dusseldorf – with high quality camera, microphone and lighting. In the picture will be shown the speaker and his presentation. A moderator leads through the lectures.

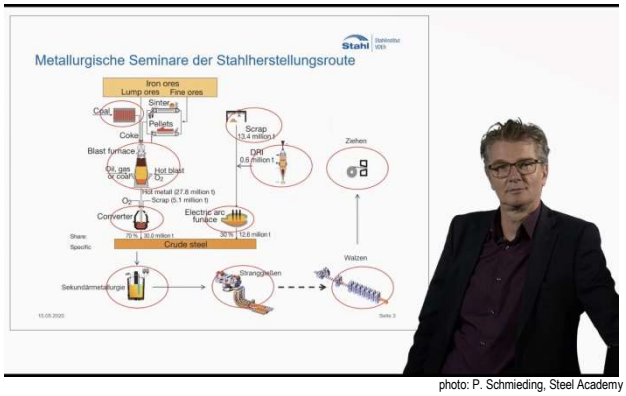

photo: P. Schmieding, Steel Academy

Online seminar - how does it work?

- after seminar registration you receive an e-mail with a link and a pass word
- at seminar's starting the link leads you to the streaming platform vimeo.com
- you log in with the pass word
- you need just a PC / laptop / tablet / mobile phone
  ⇨ no special program or software is required.

Schedule:
2 days, 4,5 hours in the morning 8.30 a.m. till 1 p.m.

Seminar handouts:
Before seminar's starting the participant can download the presentations as a pdf.

Content

- CO_2-emissions and their mitigation in the steel industry
- Hydrogen – production and importance for the economic sector
- Thermodynamics and kinetics of hydrogen-based reduction
- Injection of carbon-hydrogen carriers into the blast furnace
- History, developments and processes of direct reduction
- Iron ores for hydrogen-based direct reduction
- Hydrogen-based direct reduction with Midrex
- Hydrogen-based direct reduction with HyL/Energiron
- Hydrogen-based direct reduction with Circored
- Hydrogen-based direct reduction for iron ore fines

Organisation

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Target Group

- Supervisors responsible for decisions on metallurgy, energy, strategy, environmental protection
- Analysts, stake holders and decision makers in energy transition, low carbon economy and decarbonization
- Staffs on blast furnace, R&D and raw materials

The seminar places the emphasis on a wide overview on the subject: the first day covers the fundamentals and conditions for hydrogen-based iron ore reduction. The lectures of the second day round off the programme with practical approaches on different industrial plant concepts.

Registration Fee

€ 750,00* // € 850,00 VAT-free

* for employees of member companies and individual members of the Steel Institute VDEh. Scientific staff of universities gets a 50 % off. Also 50 % discount for each additional participant from the same company.

PROGRAMME

Tuesday, 6th of October 2020

Chapter "Fundamentals and Conditions"

08:30 **Introduction to the seminar**
P. Schmieding, H.B. Lüngen

08:35 **CO_2-emissions and their mitigation in the steel industry**
Hans Bodo Lüngen
Requirements of the EC / CO2-emissions of steelmaking routes in use / CO2-mitigation of the European steel industry 1990-2015 / Current projects in Europe to reduce CO2 in steelmaking

09:00 **History, developments, processes of direct reduction**
Hans Bodo Lüngen
Development and plants of Midrex, HyL and Circored / Other developments without importance or realization

09:45 questions and answers

10:00 **Thermodynamics and kinetic fundamentals of hydrogen-based reduction**
Karl-Hermann Tacke
Phases, reactions, equilibria / Kinetic effects: temperature, ore, particle size, porosity, gas properties and other parameters / Morphology

11:00 questions and answers

11:15 **Injection of carbon-hydrogen carriers into the blast furnace**
Peter Schmöle
Use of different auxiliary reducing agents / Hydrogen input with hot blast, coke and auxiliary reducing agents / Effects on blast furnace operations (Raceway adiabatic flame temperature, oxygen addition, reduction rates by C and H_2, top gas composition)

12:00 questions and answers

12:15 **Iron ores for direct reduction**
Rénard Chaigneau
Pellets are the natural choice for conventional DR. Also for efficient hydrogen-based reduction?

13:00 questions and answers,
afterwards end of 1st day

Wednesday, 7th of October 2020

Chapter "H_2-Processes / Applications"

8:30 **Hydrogen – its production and importance for the economic sector**
Ilona Dickschas
Principles of hydrogen electrolysis / P2X and sector coupling / Overview of references and projects

09:00 **Hydrogen-based direct reduction with Midrex**
Christian Böhm
Process Diagram / Core Equipment / Options for hydrogen enrichment / Process limitations

09:45 questions and answers

10:00 **Hydrogen-based direct reduction with HyL/Energiron**
Markus Dorndorf
ENERGIRON-ZR process / Principles of design / Process schemes/ CO_2 removal unit / High-C DRI – link to EAF process / Final products (DRI, HBI, Hot Metal) / Hydrogen utilization in ENERGIRON process

10:45 questions and answers

11:00 **Hydrogen-based direct reduction with Circored**
Tobias Stefan
Basic principles of fluidized beds / Sticking in fluidized bed based direct reduction / Process Principles Circored / History Circored plant Trinidad / Process options for ultrafines

11:45 questions and answers

12:00 **Hydrogen-based direct reduction for iron ore fines**
Johannes Schenk
FINORED and "Breakthrough Technology" / Status of technologies / Flowsheets / Principles of the design / Raw materials / Products / Further use of products / Reductants / Limits of the process

12:45 questions and answers

13:00 **end of seminar**

SPEAKERS Christian Böhm, Primetals Technologies Austria GmbH, Linz ■ Dr. ir. Rénard Chaigneau, Baffinland Iron Mines Europe B.V., Amsterdam ■ Ilona Dickschas, Siemens AG, Gas and Power, Hydrogen Solutions, Erlangen ■ Dr.-Ing. Markus Dorndorf, LOI Thermprocess GmbH, Essen ■ Dr.-Ing. Hans Bodo Lüngen, Steel Institute VDEh, Düsseldorf ■ Prof. Dr.-Ing. Peter Schmöle, Dortmund ■ Prof. Dr.-Ing. Karl-Hermann Tacke, Technical University of Berlin ■ Prof. Dr.-Ing. Johannes Schenk, Montanuniversität Leoben ■ Dipl.-Ing. Tobias Stefan, Outotec GmbH & Co KG, Köln ■ Organization: Peter Schmieding, Steel Academy, Steel Institute VDEh, Düsseldorf