Steel Academy‘s International Online-Seminar

# Ironmaking, part II: Advanced course

8 – 9 June 2021

Stahl | Steel Institute VDEh

Steel Academy

# Seminar‘s chairmen

› Prof. Dr.-Ing. Peter Schmöle
Dortmund

› Univ.-Prof. Dr.-Ing. Dr. h.c. Dieter Senk
RWTH Aachen University

# Speakers

- Dr.-Ing. Alexander Babich,
  Department of Ferrous Metallurgy, RWTH Aachen University
- Dr. Maarten Geerdes,
  Geerdes Advies, Castricum
- Dr.-Ing. Hans Bodo Lüngen,
  Steel Institute VDEh, Düsseldorf
- Dr. Robert Nightingale,
  Sydney
- Prof. Dr.-Ing. Peter Schmöle,
  Dortmund
- Univ.-Prof. Dr.-Ing. Dieter Senk,
  Department of Ferrous Metallurgy, RWTH Aachen University

- Organisation: Peter Schmieding, Steel Academy, Düsseldorf

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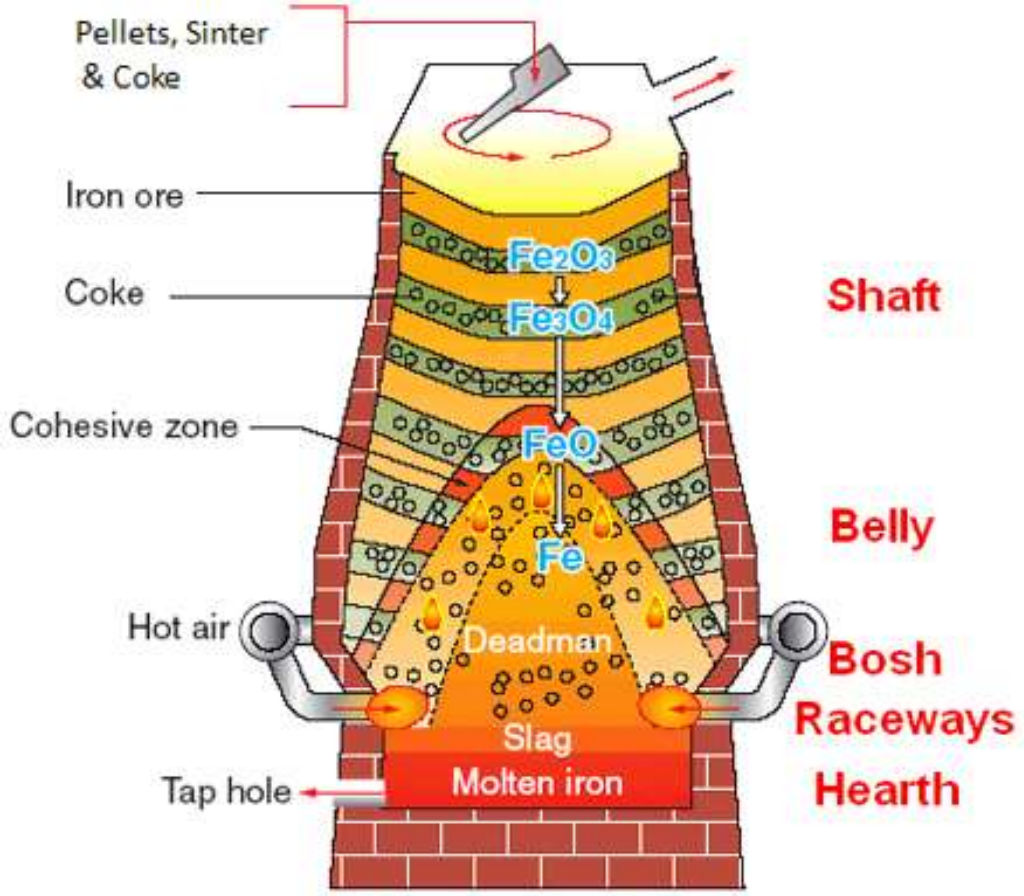
# Content of summary –

on the next slides
you see a selection
of our program

# Hearth and deadman dynamics

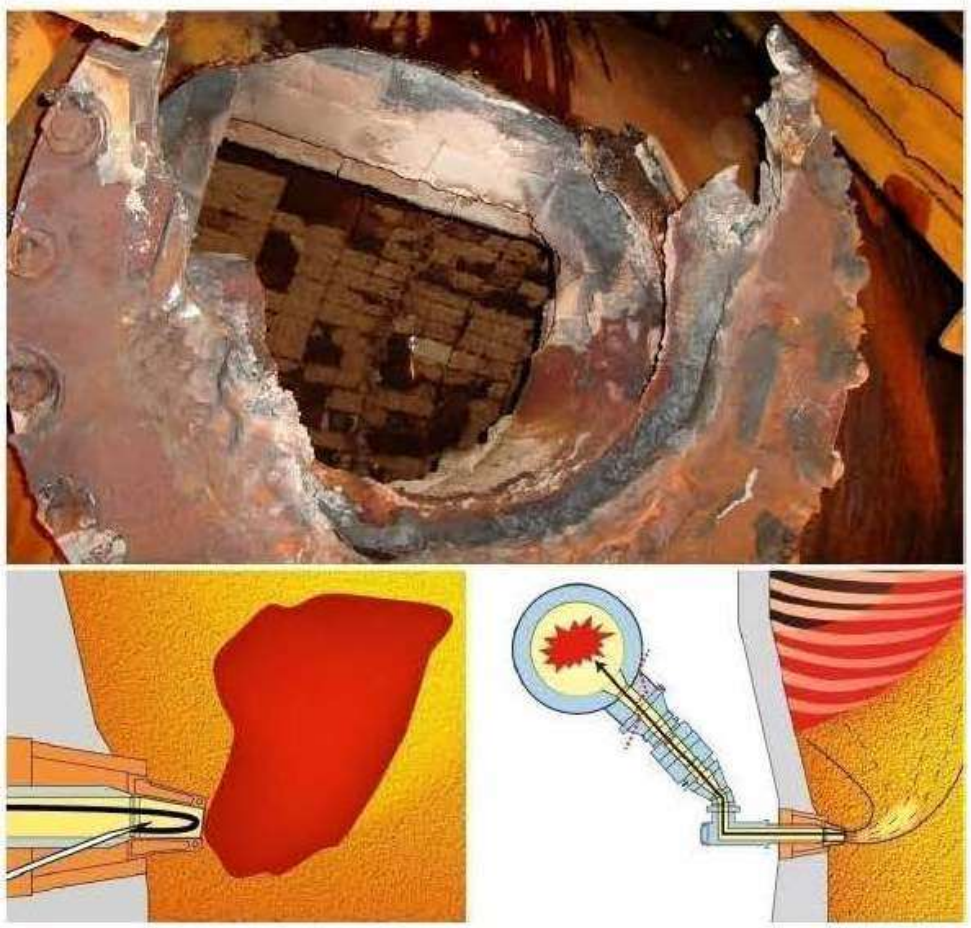
## What is the deadman? Floating or sitting?




Source: B. Nightingale, University of Wollongong

# Operational challenges

## Burden, circumferential symmetry, tuyeres, stops, starts

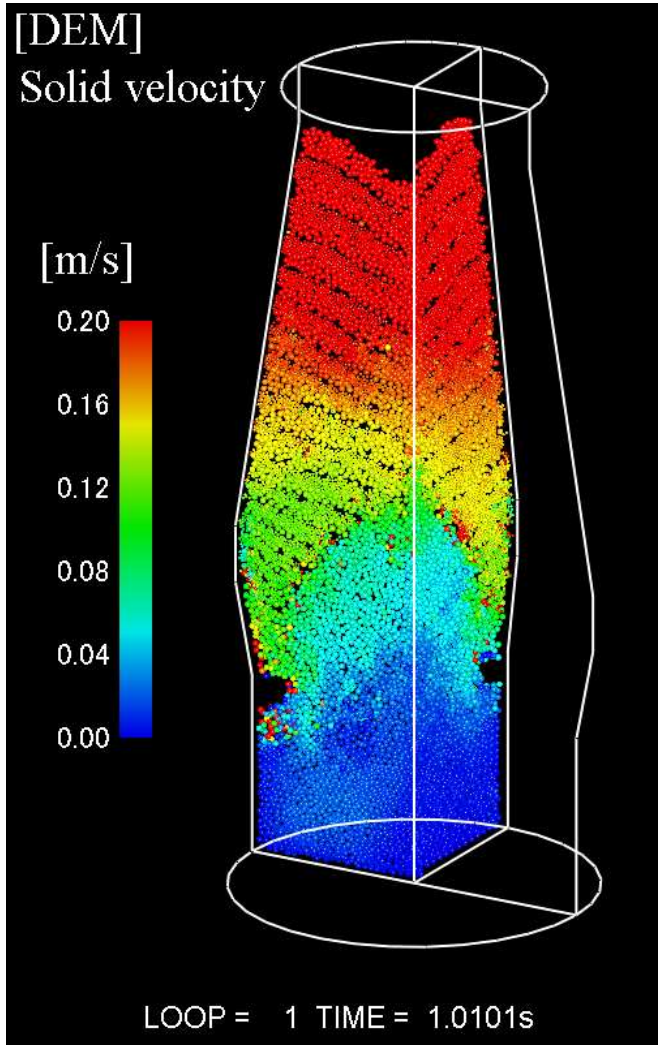


Tuyere blockage and explosion!
Preventative measures:
Delta-P over tuyere stocks or light sensor coupled to individual lances

Source: M. Geerdes

# Modelling and simulation

## Options and limits / Programs in use

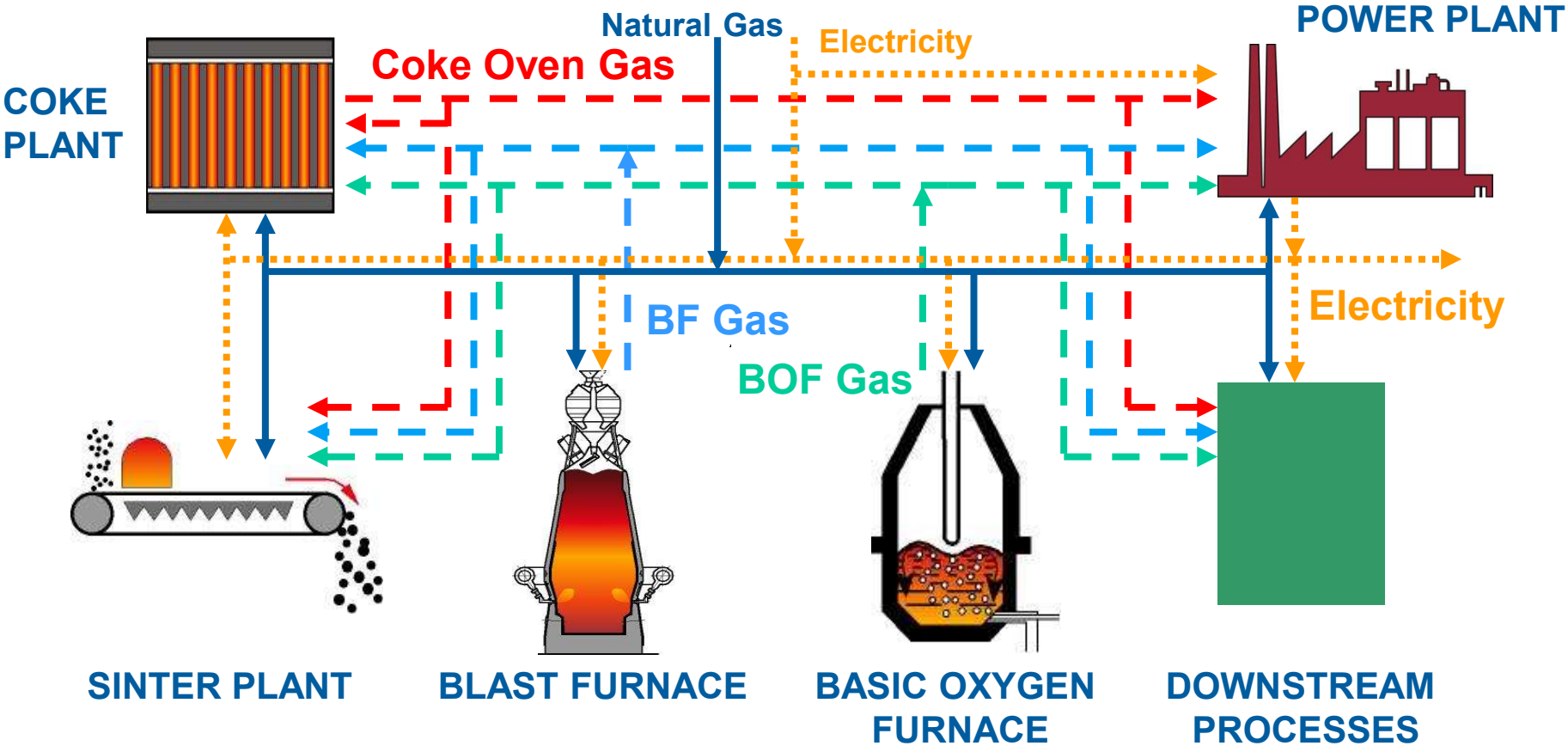



Coupled 3-D DEM-CFD model
for the whole BF

S. Natsui et. al.,
German – Japanese Workshop “Challenges in Ironmaking”,
Aachen, 2010

# Energy network

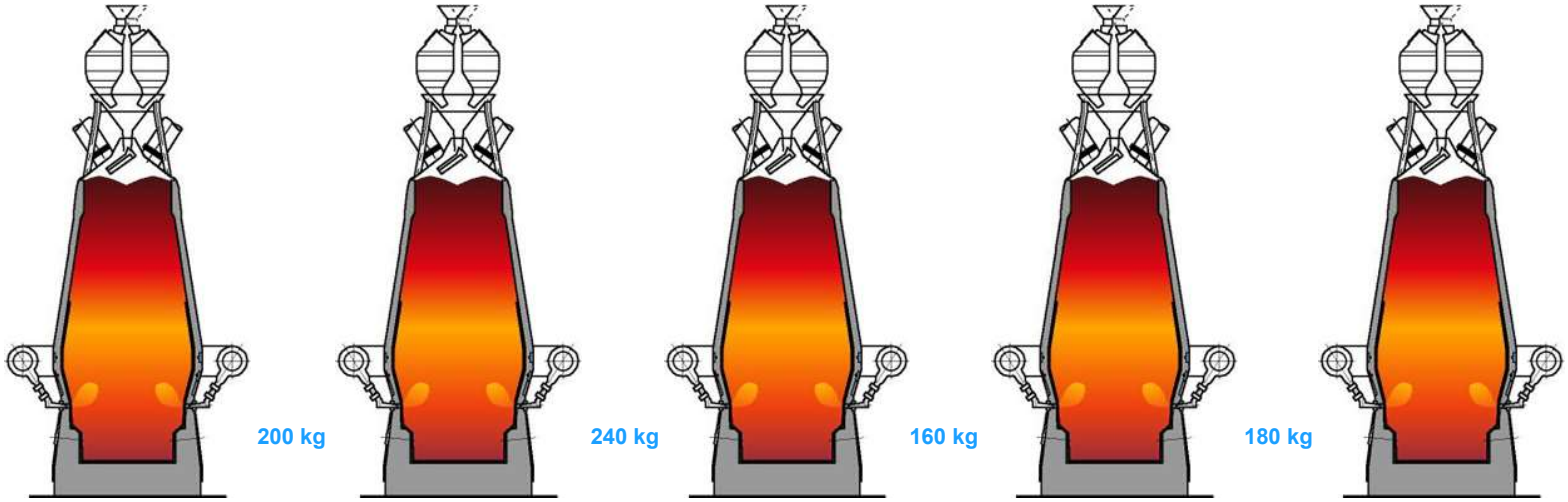
## Energy optimized production



# Various BF operation modus worldwide

## Different countries – different concepts

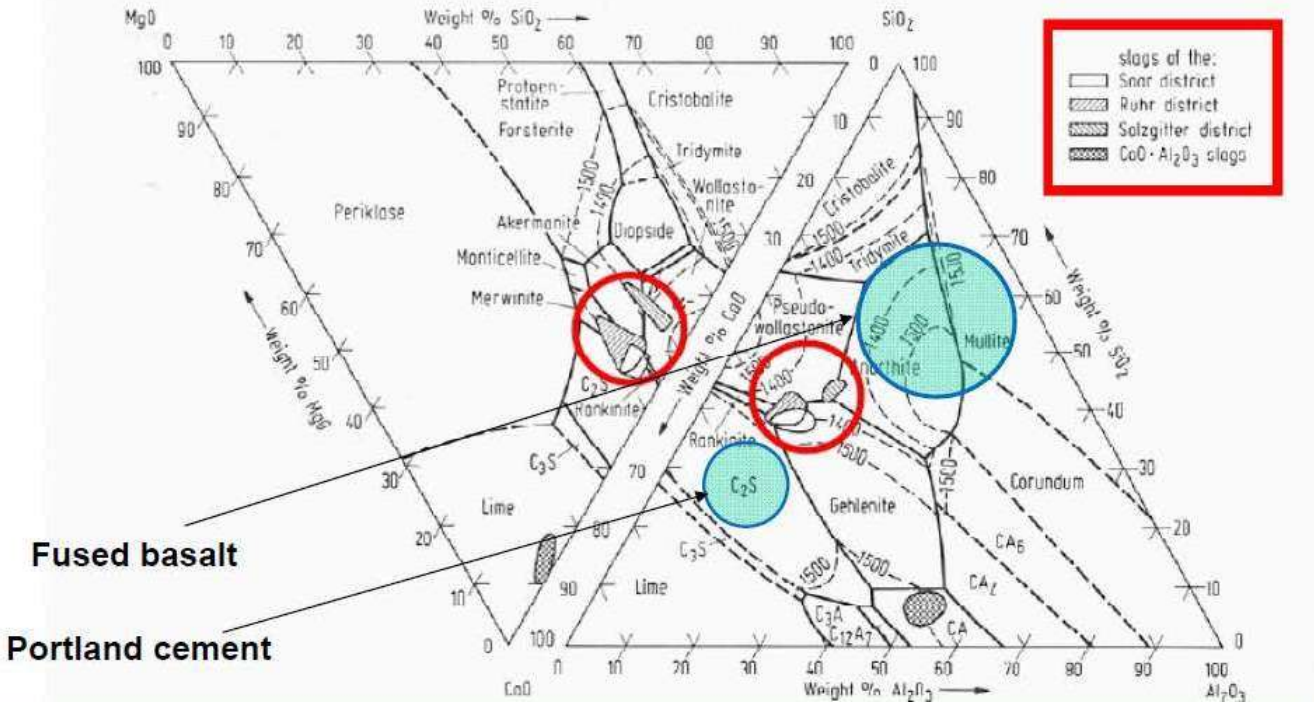
| Sinter burden | Sinter/Pellet | Sinter/Pellets/ Lump ores | Pellet burden | Pellets/metallics |
|---|---|---|---|---|
| > 90 % Sinter | 60 % Pellets<br>40 % Sinter | 45 % Lump ores<br>30 % Sinter<br>25 % Pellets | 90 % Pellets<br>10 % Briquettes<br>or others | 75 % Pellets<br>25 % Scrap/HBI |
| Slag >> 260 kg | 200 kg | 240 kg | 160 kg | 180 kg |
| Europe,<br>Japan, South Korea | Europe,<br>South America,<br>Japan, China | Europe<br>South America | Europe<br>North America | North America |



# Quality and Use of BF Slags

## Slag formation, slag control, slag applications

| Blast furnace slags in West Germany | Mass % $SiO_2$ | $Al_2O_3$ | CaO | MgO | $Fe_{total}$ | $Mn_{total}$ | $TiO_2$ | $S_{total}$ | $P_{total}$ | kg slag/t hot metal | Temperature °C |
|---|---|---|---|---|---|---|---|---|---|---|---|
| Slags from high phosphorus hot metal | 36.0 | 8.5 | 41.0 | 9.5 | 0.3 | 0.4 | 1.2 | 1.5 | 0.10 | 300 | 1400/1450 |
| Slags from low phosphorus hot metal | 37.0 | 10.5 | 40.0 | 9.5 | 0.2 | 0.3 | 1.0 | 1.5 | 0.01 | 250 | 1450/1500 |
| MgO-rich slags from low phosphorus hot metal | 38.5 | 8.0 | 35.5 | 13.5 | 0.2 | 0.2 | 0.9 | 1.5 | 0.01 | 230 | 1500 |




Chemical and mineralogical compositions of magma, cements an BF slags

Source: D. Senk, RWTH Aachen / Slag Atlas

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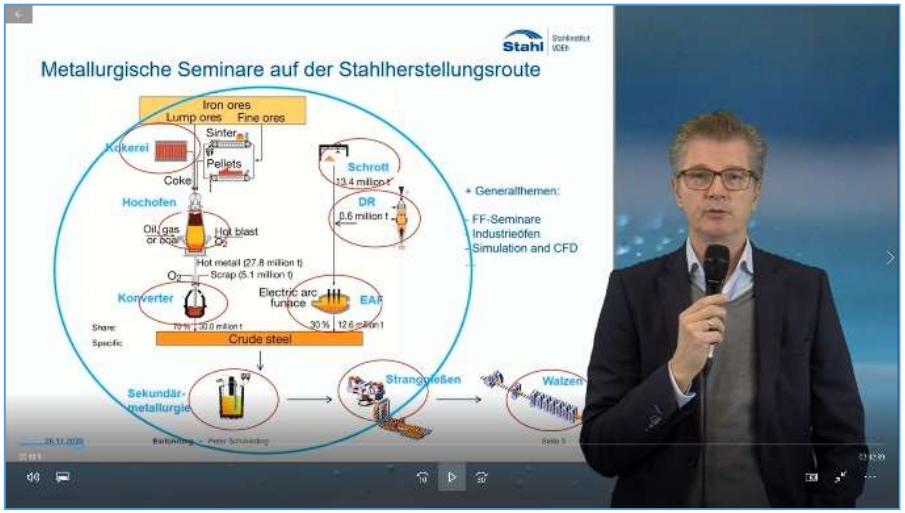
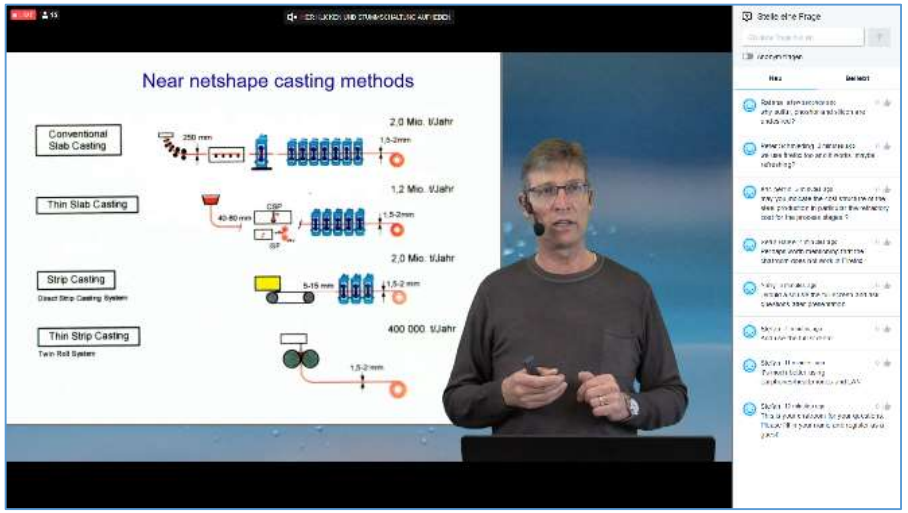
# Hydrogen-based direct reduction

## Way into the future

# What do our online seminars look like?

## Our seminar live stream - visually like a TV broadcast




The Steel Academy broadcasts its online seminars as a live stream in an innovative TV image format with chat room