Commissioning of 60 kg Moveable Wall Oven at thyssenkrupp Steel Europe AG
7th European Coke and Ironmaking Congress
14.09.2016 – Marc Schulten & Viktor Stiskala
Agenda

Background

60 kg - moveable wall oven

Commissioning phase

Outlook
Background

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Outlook
Task areas of Technology Coal & Coke
Securing the know-how at tkSE

**Coal & Coke Research**
- VIU projects to maintain competitiveness of coke production at thyssenkrupp Steel Europe AG
- Participation in international projects, co-operation with universities and third parties

**Routine Support**
- Taylor made structure of Standard based coal & coke analysis
- Safe blend operation
- Education and preservation of know-how

**Technical Assistance**
- Coal selection and assistance to coal procurement
- Technical assistance to TK CSA Brazil
- Coal – coke oriented decisions
Enlargement of the lab equipment for raw materials
Reaction towards volatile raw material markets

- Consistent enlargement of the measuring equipment at tkSE since 2010
- Ensuring the optimal raw materials supply and quality monitoring
- Expansion of the portfolio for C- and Fe-carriers
  - Coking facilities
  - Equipment for coking and PCI-coals
  - Renewing the test facilities for Fe-carriers
  - Automatic sampling stations at production plants
  - Equipment for continuous measurements
  - Equipment for refractories
Measures at Technology Coal & Coke
Installation of two new coking facilities as centerpiece

- Establishment of a new R&D center
  - Movable wall oven
  - Retort oven
  - Infrastructure for coal and blend preparation
  - Coke stabilization
- Expansion of the coal laboratory
  - Audibert-Arnu dilatometer
  - Additional Gieseler plastometer
  - Free Swelling Index
  - High temperature dilatometer
  - New microscopes
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Outlook
Project timeline

Key dates

- January 2013  Project start
- Spring 2013  Contact of suppliers
- November 2013  Start tender
- February 2014  End tender
- September 2014  Start of construction
- November 2014  Heating phase
- December 2014  First push
- 2015  Oven optimization
Moveable wall oven I
Key figures

• Oven chamber 300 x 670 x 500 mm
• Charged volume 670 cm³
• Oven construction with extra high load bearing capacity
• Electric heating systems via 6 heating rods
• Independent thyristor control of every single heating rod
• Top and stamp charging possible
• Wet quenching of coke outside in a quenching tower
Moveable wall oven II
Measurement options

- Measuring of wall pressure with an installed load cell
- Two load cells available
  - 0-40 kPa for blends
  - 0-200 kPa for dangerous coals
- Three probes for internal gas pressure and temperature
  - Insertion through doors and charging hole possible
  - 0-400 kPa
Moveable wall oven III
Schematic view
Moveable wall oven IV
View on both sides

Pusher side

Coke side
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Outlook
Oven and operation adjustments after the first trials
Target: Meeting the needs of our customer

- Trials with different heating profiles
  - Constant temperature
  - Heating ramps
- Coking time variations (11-14 h)
- Trials with different bulk densities
- IGP probe design adjustments
  - Reduction of the probe diameter
  - Change from slots to holes
- Coke stabilization at different heights
- Optimization of the coal preparation
Optimization of the operations I
Wharf coke qualities as starting point

![Graph showing wharf coke qualities as starting point](image)
Optimization of the operations II
Implementation of stabilization

![Graph showing the comparison between wharf coke and stabilized coke across different trials. The x-axis represents the trial number, and the y-axis represents the I_40 value in percent. The graph compares wharf coke and stabilized coke, with stabilized coke showing a higher I_40 value across the trials.]
Stabilization
Simulation of stabilization effects at the coke plant

- Erection of stabilization tower to ensure repeatability
- Stabilization height currently over 30 metres
Optimization of the operations III
Adjusting heating regime and bulk densities

![Graph showing optimization of heating regime and bulk densities. The graph compares wharf coke and stabilized coke across different trials. The x-axis represents trial numbers, and the y-axis represents the I_{40} [%]. The graph highlights the adjustments made to heating and bulk density, with stabilized coke showing a higher I_{40} value compared to wharf coke.](image)
Adoption of heating regime
Implementation of heating ramps leads to a significant improvement
Improvement of IGP measurement I
Atypical IGP peaks with original probe design

![Graph showing temperature, wall pressure, and internal gas pressure over time.](image-url)
Changes of the IGP probe design
Slots replaced by holes to minimize contact area

Old design

New design
Improvement of IGP measurement II

Typical IGP performance can be achieved with new design
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Outlook
Future tasks for Technology Coal & Coke

- Further oven optimization projects
- Expansion of the infrastructure
- Investigations on the optimal pet coke use
- Coke size analysis
- Image analysis of coke
- Enlargement of the analysis portfolio for coke
- Weathering influences
Thank you for your attention

Are there any questions?