Test measurement concept and investigations in the Oxyfuel Pilot Plant in Schwarze Pumpe

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Basic principle of the test measurement

- Different test campaigns have been defined aiming at investigation of a certain operating mode or plant configuration, e.g. certain burner, operating mode (air/oxyfuel)
- Each test campaign is divided into a number distinct investigations of certain parameters, e.g. burner and overall stochiometry, ash mineralogy investigations
- Routines with various laboratories have been established to handle analysis, new methods to be realized, e.g. analysis of liquid CO2 product
Test measurement concept

- Centralized data acquisition system for data storage and evaluation adapted to handle a large variety of data sets
  - analysis reports, off-line measurements
  - transfer from data loggers, etc.
- Direct link to DCS, time synchronisation, operational data transfer etc.
- Manually received measurement data is transferred retroactively into data acquisition system
- Remote access realized to simplify process evaluation and follow plant performance
Minimizing air ingress

- All measurement ports have been equipped with ball valves and seals to minimize air ingress
- Air ingress in steam generator (1\textsuperscript{st}, 2\textsuperscript{nd} and 3\textsuperscript{rd} draft as well as ESP) is low - defined air ingress measurements will be performed
- Hopper systems with CO\textsubscript{2} flushing installed at removal points
  - inflatable seals at some locations
  - wear & tear issues
Applied techniques in furnace

• Suction pyrometers are used for in-flame measurements. Temperatures up to 1400°C have repeatedly been measured.
• Gas suction probes equipped with hot gas filters
• Heat flux meters are installed in furnace walls for monitoring.

• Additional measurement techniques have been tested, e.g. 2-colour pyrometric system, evaluation not yet completed.
• Other systems combining FTIR and optical methods will be evaluated.
Flame images from air and oxyfuel operation

• Different operating modes of the burner have been investigated in detail (air and air and the different mode for oxyfuel firing).

• Main parameter of interests: flue gas recycle rate and excess O2 in the flue gas.

Air flame

Oxyfuel flame
Increasing O2 concentration in oxidant

NOTE: Different swirl settings have been realized for air and oxyfuel firing – Not a required feature for oxyfuel
A shift in the heat flux to the furnace walls can be observed in the transition from air to oxyfuel firing.
Investigations on corrosion

- High and low temperature corrosion is investigated by means of conventional material probes exposed to air and oxyfuel atmosphere
- Oxyfuel exposure time of ~2000h reached by end of September

- Probe types:
  - Constant and gradient temperature
  - Electro-chemical probes for online monitoring
  - Deposit probes
Upcoming investigations – medium and long term issues

• Different burner geometries will be tested, jet- and swirl burners
• Variation of fuel qualities
  – moisture content
  – sulphur content ⇒ direct effect on sulphur chemistry and thus corrosion issues
• DeNOx using SCR, very little experience for lignite
  – Steam generator is prepared to be equipped with SCR
• Alternative CO2 compression plants will be tested
• Bituminous coal
• Biomass fuels in combination with Oxyfuel
Thank you!