Validation of the oxygen buffering ability of bed materials used for ocac in a large scale cfb boiler

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Validation of the oxygen buffering ability of bed materials used for OCAC in a large scale CFB boiler

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Fluidization XV – Fairmont Le Chateau Montebello
Quebec, Canada
Circulating Fluidized Bed boilers
Background to OCAC

- Spinoff from Chemical Looping Combustion
- Addition of ilmenite as part of bed inventory
- Possibility to provide an increased oxygen distribution
Oxygen Carrier Aided Combustion
Oxygen Carrier Aided Combustion

\[ Me + \frac{1}{2} O_2 \rightarrow MeO \]

\[ nC_iH_j + xMeO \rightarrow xMe + yCO_2 + zH_2O \]
Oxygen Carrier Aided Combustion

\[ Me + \frac{1}{2} O_2 \rightarrow MeO \]

\[ nC_iH_j + xMeO \rightarrow xMe + yCO_2 + zH_2O \]
Aim: Validation of the OCAC concept

- Earliest investigation with 100% ilmenite in industrial relevant CFB conditions

- Evaluate oxygen buffering ability experimentally

- Validate experiments by identifying conceptual patterns with a dynamic pulse response
Research from lab to commercial scale

Chalmers 12MWth research boiler

E.ON commercial waste boiler 80MWth

Continuous operation since February 2016
Experimental: Procedure and Results

• Reference case with 100% silica sand was compared to operation with 100% ilmenite

• Instantaneous fuel pulse of 8MW on top of the 6MW base load
Dynamic pulse response

Flue gas concentrations

- Sand
- MeO

Volatile Rich
Volatile Poor

Cyclone

Air
Fuel
Bed Material

Oxygen (mole%)
Unburned species (mole%)
Dynamic pulse response

Volatile rich
Volatile poor

Flue Gas

Cyclone

Volatile rich
Volatile poor

Degree of oxidation

Time (s)

0 400
0 400
Concluding remarks

- Initial experience with MeO in large scale
- MeO has oxygen buffering properties
- Enhanced utilization of oxygen in time and space
Thank you!

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