

CLEEN

Cluster for Energy and Environment



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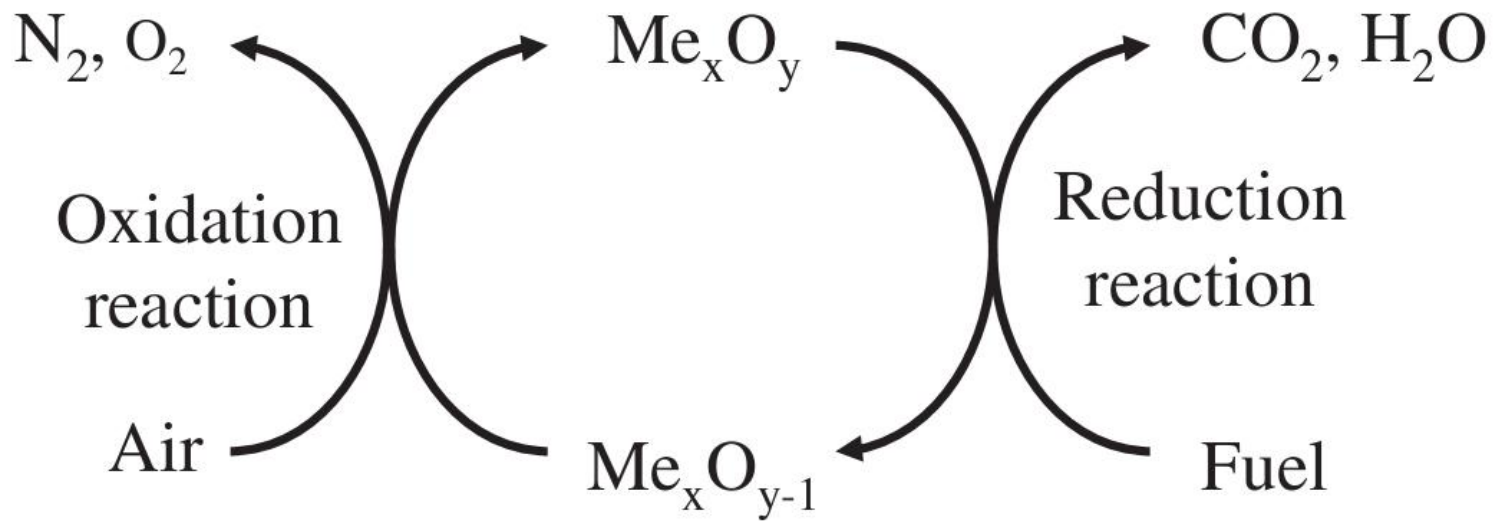
Carbon Capture and Storage Program

CLC EXPERIMENTAL TEST FACILITY

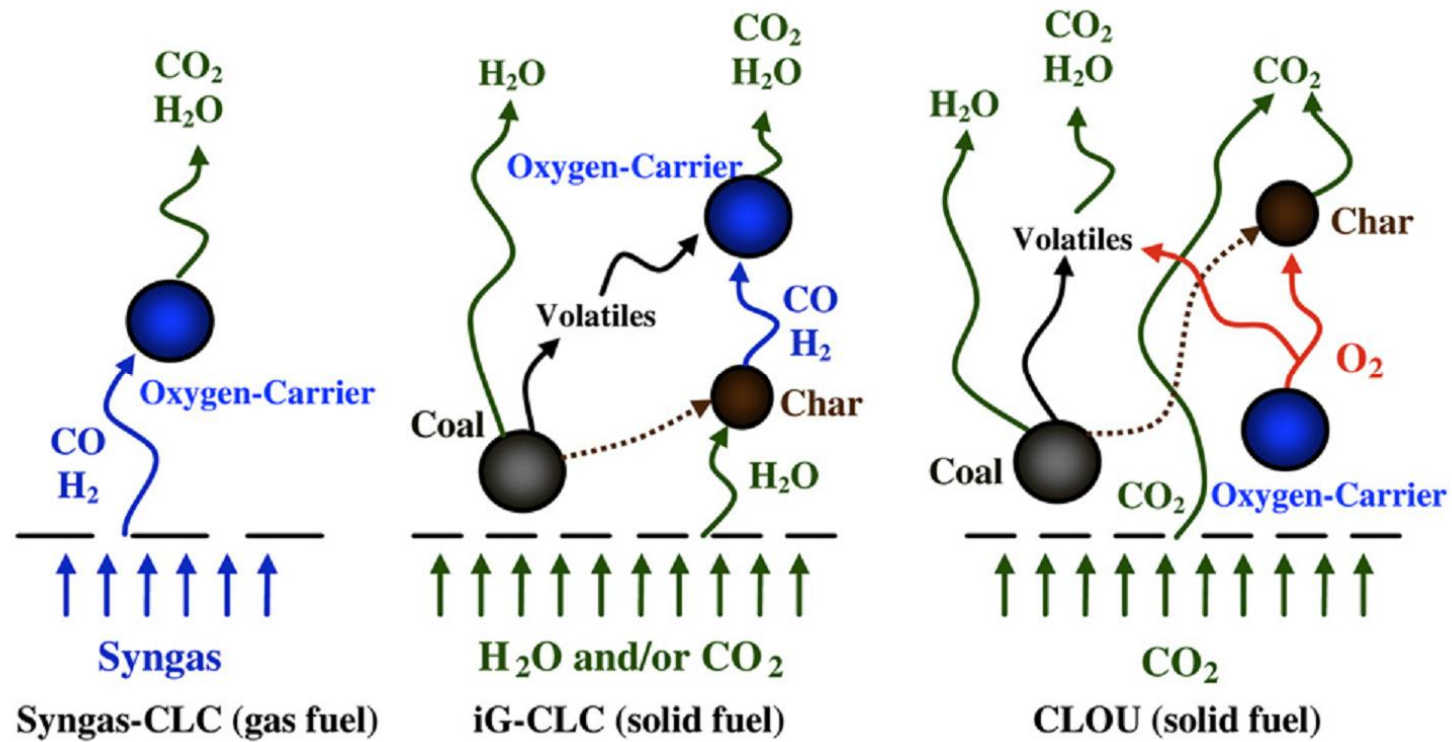
Matti Tähtinen, VTT



Basic reactions at hot conditions



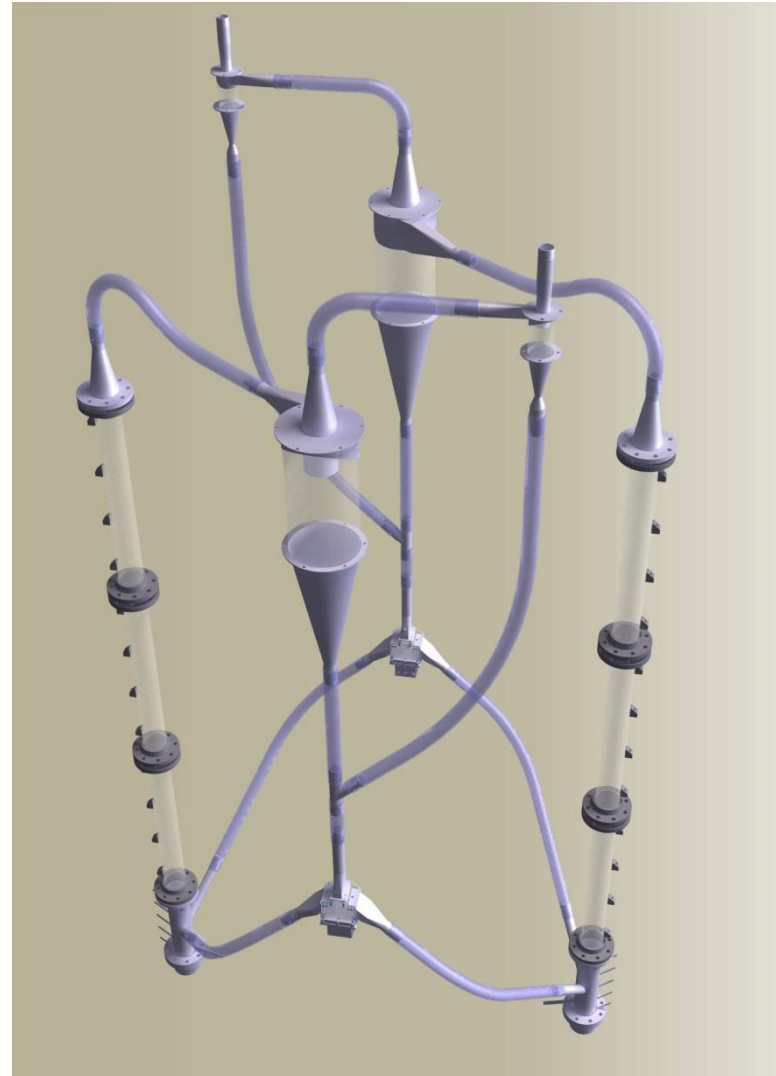
Combustion in chemical-looping



J. Adanez et al. / Progress in Energy and Combustion Science 38 (2012) 215–282

Reactor system concept

- Two circulated fluidized bed reactors
- Reactors are interconnected with two double exit loop-seals
- Pressure difference between reactors can be adjusted





Current concept / test rig design

Advantages

- More versatile process configuration
- Control of inventory at reactor
 - Possibility to use/test different oxygen carriers
- Possibility to adjust solid mass flow by fluidization
 - Wide operational area

Disadvantages

- Gas leakage between reactor may increase
- More complicated operation and process control



Cold model of dual circulated fluidized bed

- Why cold model?
 - Possibility to see circulation and fluidization
 - Cheaper to test different configurations
 - Safety
 - New process
 - New concept
- What we can do with it?
 - Proof of concept, does this concept work?
 - Hydrodynamic research
 - High density fluidized bed research



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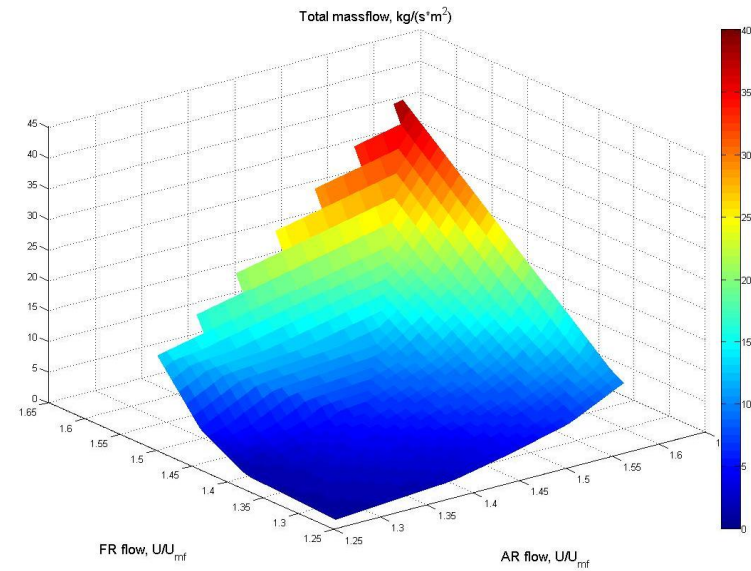
Cold model of double exit loop-seal

Air reactor Standpipe Fuel reactor

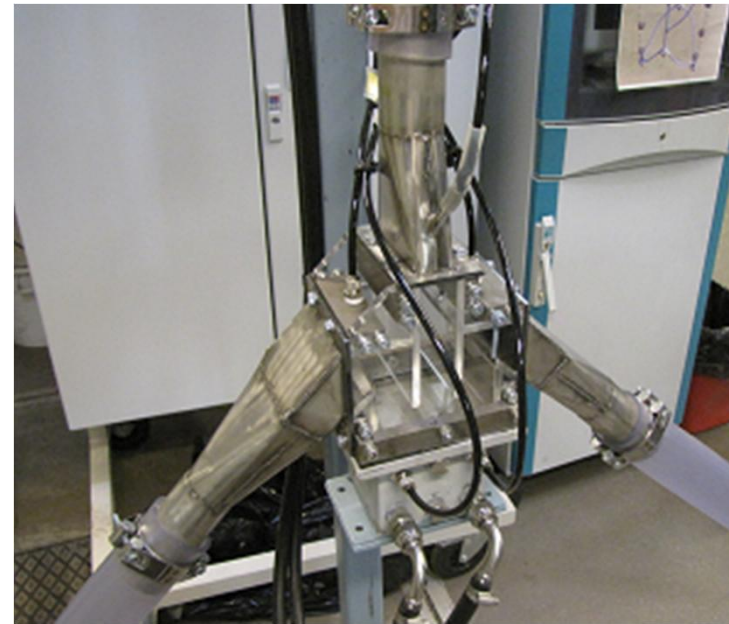


Air boxes

Recycle chambers



Cold model of double exit loop-seal





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Carbon Capture and Storage Program

Cold model commissioning

- Successful commissioning
- Small gas leakage problems
 - Sealing adjustments
- Double exit loop-seal works
- Circulation obtained
 - Single reactors (40mm and 69mm)
 - Both reactors separately and interconnected
- Work to do:
 - Decrease “dead inventory”
 - More sealing



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Carbon Capture and Storage Program

Upcoming research activity

- Definition of operation area
- Control of solid flow over double exit loop-seal
- Gas leakage over double exit loop-seal
- Adjust of solid inventory between reactors
- Verification of scaling
- Design for hot conditions test rig



Questions? Comments?