Advanced Coal Conversion
University of Kentucky Center for Applied Energy Research

Chemical Looping Technology:
1. Application of Chemical Looping (CL) with Spouting Fluidized Bed for Hydrogen-Rich Syngas Production from Catalytic Coal Gasification (Supported by DOE – NETL, DE-FE0024800)
2. Coal-Sided Pressurized Chemical Looping Combustion with a Spouting Fluidized Bed (Supported by DOE – NETL, DE-FE0025988)

CLC Scheme

Key Features
- CLC: heat release in normal combustion
- CLC: poly-generation (fuel & power)
- High purity CO2 stream ready for sequestration
- High purity syngas: ~0.75/1
- Low energy penalty

Applications
- Coal gasification and H2-rich syngas production
- PCLC Combined Cycle Power Generation

Focus at UKy-CAER
- Cost-effective oxygen carrier development (Fe-based, olivine & solid waste)
- Design & technical-economic evaluation of PCL for power generation/syngas production
- Demonstration of PCL/CLC (1-5MW, fixed / fluidized /spouted bed)
- Fundamental kinetics of coal gasification/OC reactions, pollutants, coal impurities

1. Fundamental
2. TG-MS
3. Mini Reactor
4. Bench-scale Unit
5. Pilot-scale Unit - 50 kW, Pressurized Unit
6. Collaboration with China
7. Challenges/hurdles

Facility Description and Process Units
Opposed Multi-Burner Gasification and Coal Water Slurry

Introduction and Overview
- The objective is to advance the design, construction and commissioning of an integrated coal/biomass-to-syngas (IPTS) facility at a capacity of 1 MW/day at UKy-CAER
- A test platform to take lab scale work to the next level of scale-up and to have a fully integrated gas to fuel production continuous proof-of-concept facility

Our Solution

GC agglomeration
Limited gasification rate
Spouted Fluidized Bed
Pressurizing Catalyst

Small-scale Pilot Plant for the Gasification of Coal and Coal/Biomass Blends and Conversion of Derived Syngas to Liquid Fuels via Fischer-Tropsch Synthesis
U.S. Department of Energy (DOE) - National Energy Technology Laboratory (NETL)
DE-FE0010482

Facility Description and Process Units

1. Fuel Reactor
2. Air Reactor
3. Air Compressor
4. Loop-seal
5. Ash cooler
6. Gasification Unit
7. Purification Unit
8. Feed Preparation

Platform for Future Research
In-Site WGS and Warm Sulfur Removal