Methods to Improve Advanced Gasification and Fuels for Power Generation
Research Team
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Research focus
- Methods to improve advanced gasification and fuels for power generation

Background
- Alternative power generation techniques and fuels are sought to increase the use of nation’s natural resources and improve efficiency

Objectives
- Obtain equipment to quantify fuel environment and fuel behavior in gasifiers
- Provide data for models to improve gasifier designs
- Develop experimental techniques and models to improve fuels
- Investigate fuel blending as potential transition fuel
Technical Highlights

Equipment Obtained

Dantec PIV system
  - Digital Image Analysis (DIA) for particle tracking inside fluidized beds

Microscale combustion calorimeter (MCC)
  - Heat release rate of fuels versus temperature
  - Effective heat of combustion of pyrolysis gases as well as fuels in oxygen environments

Shimadzu GC-2014 AFC Dual Inj-Pac Gas Chromatograph with dual FID and TCD detectors
  - Combustion product measurement

Shimadzu QP2010S Gas Chromatograph/Mass Spectrometer (GC/MS)
  - Combustion product measurement and identification
Fuel blending and transition fuels

- Optimization methods to develop fuel blends with desired burning characteristics
  - Focused on loosely mixed fuels which show additive behavior
  - Uniform heat release rate versus temperature
  - Improved fuel efficiency based on overall energy for decomposition and output

- Developing blended briquettes of compressed biomass and coal as a transition fuel
  - Preliminary data indicates blended briquette burning different than loosely mixed fuels suggesting synergistic effect due to compression
  - Compressed blended fuel has lower peak NOx emissions compared with loosely mixed fuels
Publications (cont.)


Highlights

- Developed experimental data to validate hydrodynamics of CFD codes predicting fluidized bed behavior
- Procured thermal analysis and combustion equipment required to characterize fuel combustion properties and performance
- Developed methods to characterize fuels and fuel blends
- Evaluated blended coal-biomass briquettes as potential transition fuels for coal-fired plants
- Studied complex flow structures in gas turbine combustor simulators

Publications

Selected publications (complete list attached)


Other Key Successes

- Brown, S., M.S. Thesis, Spring 2012
- Agarwal, G., Ph.D. Dissertation, Fall 2013
- Roy, A., PhD Dissertation, Spring 2014

Key Collaborations

- Gerald Luttrell – Mining Engineering
- Bingyu Zhou – Horticulture
- Danesh Tafti, Francine Battaglia, Uri Vandsburger – Mechanical Engineering


