Characterizing Impacts of Dry Coal Feeding in High Pressure Oxy-Coal Combustion Systems

For Energy and Environmental Solutions

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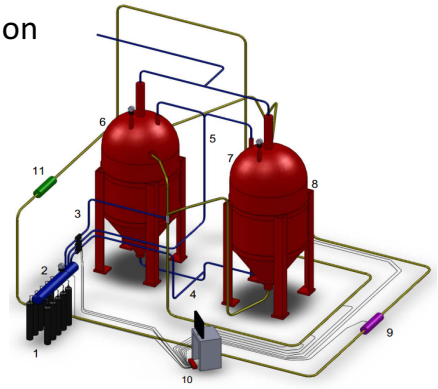
ABSTRACT: Reaction Engineering International (REI) is teaming with the University of Utah; South East University, Nanjing, China; the Electric Power Research Institute (EPRI); Corrosion Management, Ltd., UK; and Praxair to design and construct a dry pulverized coal feeding and firing system for a 32 bar, 300kW entrained reactor. The impact of dry feeding on design of the burner and firing system, radiative heat transfer in the burner zone, slagging/fouling propensity and high temperature corrosion will be evaluated. Experiments will be tailored to provide a comprehensive data set including, measurements of heat flux profiles, investigation of flame shapes, sampling and analysis of ash aerosols, measurement of surface deposition rates, and sampling and analysis of slagging deposits. Resulting test data will be used to validate mechanisms describing heat transfer, ash deposition, and corrosion. An economic analysis/comparison will be performed illustrating the relative performance of dry fed and slurry fed systems.

Pulverized Coal Feeder Design & Construction

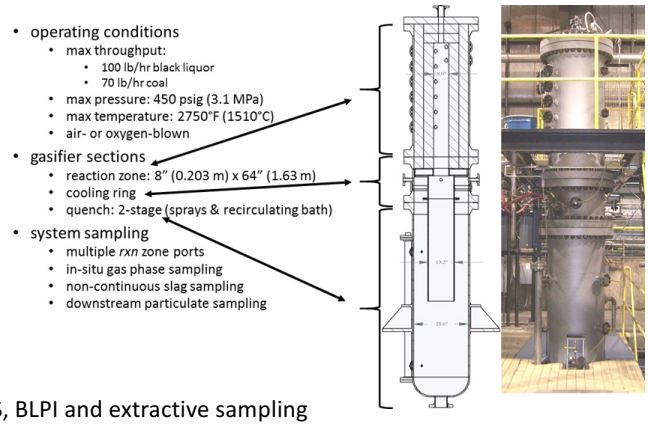
- Design based on SEU's decades of related experience
  - Leveraging technology developed for and implemented into the Shell Gasification Process
  - Tailored for integration with the University of Utah 32 bar 300 kW entrained flow reactor
- Focus on minimizing gas transport requirement



1-nitrogen cylinder; 2-buffer tank; 3-supplementary gas; 4-fluidizing gas; 5-pressurizing gas; 6-hopper; 7-hopper; 8-load cell; 9-electrostatic charge sensor; 10-data acquisition system

Entrained Flow Pressurized Reactor Preparation

- Modify high pressure reactor for temperatures and gas compositions associated with combustion
- Upgrade temperature and pressure sensing, control and safety systems
- Install support structure and gas handling systems required for dry feed system
- Design and install dry pulverized coal burner
- Integration of advanced sensing equipment

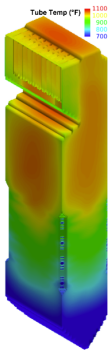


Testing with Minimal CO_2

- Temperature and Heat flux characterization
- Particulate/deposition characterization using SMPS, APS, BLPI and extractive sampling
- Corrosion characterization using electrochemical sensing

Advanced Modeling Extension and Validation

- Development and evaluation of advanced models in prediction of radiative heat flux, soot behavior, particle pyrolysis, oxidation/gasification, mineral matter behavior (vaporization, fume formation, deposition), and corrosion
- Use of advanced CFD and process modeling to perform a preliminary evaluation of potential efficiency and size advantages attributable to high pressure and dry feeding



Economic Comparison of Slurry Feed and Dry Feed Approaches