Title: Advancements in Separations and Modeling for Carbon Capture
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The National Energy Technology Laboratory (NETL) Office of Research Development (ORD) is currently investigating the development of technologies for capture of carbon dioxide from coal-fired power plants. Investigative studies and research have closely examined and are beginning to address the problems associated with CO_2 capture for various types of plants with emphasis on pulverized coal power plants and Integrated Gasification Combined Cycle (IGCC), a clean coal technology and a significant component of future power generation which allows efficiency enhancement, offers the potential to benefit the environment and could provide low carbon fuel by producing hydrogen, electricity, and liquid hydrocarbons. This presentation provides an update on these projects to highlight advanced CO2 separation and capture technologies currently under development at NETL-ORD.

For application with IGCC power plants, several technologies have been investigated for co-production of high purity hydrogen with recovery of CO_2 ready for sequestration. Focus has turned towards membrane technology for its simplicity, modular design, and ease of scaling. Membranes have already demonstrated the capability to separate H_2 and CO_2 in various applications and types of systems but must overcome elevated temperatures and pressures as well as degradation by contaminant gases and particulates. A study has been conducted evaluating the use of a variety of ionic liquids in supported ionic liquid membranes for the capture of CO_2 from streams containing H_2. In a joint project, researchers at the University of Notre Dame synthesized and characterized ionic liquids, while the researchers at the National Energy Technology Laboratory incorporated candidate ionic liquids into supports then evaluated the membrane performance for the resulting materials.

NETL is also undertaking concurrent modeling studies to investigate the integration of advanced carbon capture technologies into various power plant designs. One investigation is focused on the application of Multiphase Computational Fluid Dynamics (CFD) for the simulation of solid-sorbent based CO_2 capture systems. This will compliment existing experimental and process modeling activities, and leverage the laboratories expertise in multidimensional reacting multiphase flow simulation. Specifically, the project will extend the approach which was successfully used to simulate a sorbent-

based sulfur (H_2S) removal system to CO_2 systems. The approach is built upon the Eulerian-Eulerian multiphase model with a grain model for solid-gas reactions. It is expected that the parameters and possibly the variant of the grain model will need modification for realistic simulations of CO_2 systems.