This Week at NETL

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Novel Carbon Capture Sorbent Mimics Biological Process

Inspired by the natural affinity of amino acids for carbon dioxide, collaborating scientists at NETL and West Virginia University, an NETL-Regional University Alliance partner, have developed supported nanoporous microspheres immobilized with amino acid ionic liquids (AAILs) as robust sorbents for carbon capture. The AAILs can be facilely immobilized into porous support materials, and the resulting sorbents exhibit fast kinetics, good sorption capacity, and easy regeneration. Described in the *Journal of Materials Chemistry A*, the work presents a strategy for developing AAIL-functionalized sorbents with high capacity and fast CO_2 transport kinetics.

NETL Study Examines Sources and Fate of Inorganic Carbon Dissolved in Coal Mine Drainage

NETL researchers, in collaboration with NETL-Regional University Alliance partners at West Virginia University and the University of Pittsburgh, utilized multiple stable isotopes to assess the sources and fate of inorganic carbon dissolved in the water draining from an abandoned coal mine in western Pennsylvania. Stable isotope data were used in conjunction with other geochemical information to differentiate between new and older sources of carbon at the site. The carbon isotope signatures of dissolved inorganic carbon were very sensitive to shifts in dissolved CO_2 concentrations, corroborating the value of this technique in demonstrating CO_2 evasion from freshwater streams and rivers. Rivers have been estimated to transport approximately one gigaton of carbon from terrestrial to marine systems, and thus play a major role in the global carbon cycle. The study is detailed in the peer-reviewed Elsevier publication *Applied Geochemistry*.

NETL Collaboration Characterizes Brazilian Coal Field for CCUS Application

Working with colleagues at Brazil's Pontifícia Universidade Católica Do Rio Grande Do Sul, NETL researchers evaluated the CO_2 sequestration potential of the Charqueadas coalfield in southern Brazil's Paraná Basin. Since most Brazilian coals are characterized as high-volatile bituminous and sub-bituminous coals with high mineral-matter content, major research efforts focus on enhanced coalbed methane recovery in conjunction with geologic CO_2 storage in the coal seams. Characterization of core samples taken from the I2B seam suggests that the lower portion has significant potential for carbon sequestration. A low permeability that makes the upper portion unsuitable for direct injection of CO_2 could make it a good secondary seal. The study is discussed in the Elsevier publication *International Journal of Coal Geology*.

NETL-RUA Team Extends Viscosity Models for Hydrocarbons to High-Temperature and High-Pressure Conditions

Collaborators at NETL and the University of Pittsburgh, an NETL-Regional University Alliance partner, have extensively evaluated various combinations of equation of state viscosity models for hydrocarbon components at high temperature (533 degrees Kelvin) and high pressure (276 megapascals). These conditions are encountered in ultra-deep porous sandstone or carbonate layers that retain crude oil or natural gas. Applying the perturbed-chain statistical associating fluid theory model to calculate the fluid density for input to the frictional theory viscosity model, the NETL-RUA team can now arrive within ± 2% of the reference value for normal alkanes at pressures up to 276 megapascals. Moreover, the NETL-RUA team has, for the first time, determined free volume theory parameters that provide reliable viscosity values over the entire range of

temperatures to 533 degrees Kelvin and pressures to 276 megapascals for aromatics and cycloalkanes, as well as for CO_2 and both normal and branched alkanes. The work is described in the American Chemical Society publication *Industrial & Engineering Chemistry Research*.

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