This Week at NETL

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Ramgen Makes Progress on Novel Compressor Concept in NETL-Sponsored Project

Using their novel "Gen 2" concept, Ramgen Power Systems of Bellevue, Wash., has for the first time achieved supercritical CO_2 at the discharge of their proprietary gas compressor in an NETL-sponsored project. In the Gen 2 concept, the axial machine uses a single motor-driven stage of impulse blades to impart supersonic velocity to the working fluid, which then enters a number of parallel stationary flowpaths that serve as supersonic diffusers. Standing shock waves are established in the throat of each flowpath, with an associated rapid rise in pressure (conversion of kinetic energy to pressure) as the working fluid becomes subsonic. The first Gen 2 test recently achieved a pressure ratio (PR) of 7.74:1 at an inlet pressure of 135 pounds per square inch absolute (psia). A subsequent test run reached a PR of 6.25:1 at an inlet pressure of 185 psia, achieving supercritical CO_2 at the discharge. Target performance is a PR of 8.4:1 at an inlet pressure of 200 psia. The ultimate PR target for a single-stage Ramgen compressor is 10:1, to be pursued in a subsequent design iteration. The tests were carried out at Ramgen's purpose-built 10 MW test facility located at a Dresser-Rand Group (Houston, Texas) facility in Olean, N.Y. If successful, this concept may hold cost advantages (smaller, fewer stages, opportunities for thermal integration) over commercial industrial-scale compressors (inline or integrally geared centrifugal machines) for CO_2 compression.

NETL's Gulf Of Mexico Geocube Connects Users to Data and Information

The first NETL Geocube, a flexible, customizable web-mapping application, was released on June 28, focusing on the offshore Gulf of Mexico (GOM) region. The new Geocube supports NETL's integrated assessment model for evaluating and reducing risks associated with extreme offshore hydrocarbon development. The GOM Geocube integrates numerous spatial datasets, allowing the user to view and analyze spatial information related to the offshore GOM region. The information includes subsurface geologic data, oil and gas infrastructure, water-column physical and biological information, and numerous human marine and coastal activities, such as tourism and recreational and commercial fishing. The Geocube connect users to the data and information in NETL's Energy Data Exchange (EDX), integrating EDX's repository of data and information with current data feeds for spatial information. Users have the flexibility to develop maps with spatial elements of interest to them and export and download their custom web-map and/or the underlying datasets. Initial data and functionality for the GOM Geocube are available to users now. As NETL research progresses, additional Geocube regions will be added. New data layers and functionality will also be made available through incremental updates.

NETL and WVU Develop Nanometer-Sized Plasmonic Heaters for Catalytic CO_2 Conversion

A team of researchers from NETL and West Virginia University (WVU) has developed a new class of materials capable of converting visible light into thermal energy, which can be used to drive the catalytic transformation of CO_2 to methane, carbon monoxide, and other light gases. The materials rely on a unique heating mechanism in which light resonantly excites the collective motion of electrons, called plasmons, in nanometer-sized metal particles. The excited electrons dissipate their energy by colliding with the crystal lattice of the nanoparticles, generating heat in a process comparable to the ohmic heating that occurs when electrical currents are run through conducting metals. The team has developed several catalyst systems that rely on using nanoparticulate gold (Au) and other materials as the optically active plasmonic heater and zinc oxide (ZnO) as the catalytically active substrate. Experimental results show that low-intensity visible light,

comparable to what is achieved with standard solar concentrators, can heat the Au-ZnO catalysts up to ~600 °C in a controlled fashion, with product selectivity dictated by light intensity. The results are described in an article appearing in Issue 15, 2013 of the international journal *Nanoscale*, published by the Royal Society of Chemistry. A U.S. provisional patent has also been filed on this technology.

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