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DOE Continues Long-Running Minority Educational Research Program

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Washington, DC - Four projects that will strengthen and promote U.S. energy security, scientific discovery and economic competitiveness while producing a diverse next generation of scientists and engineers have been selected as part of the U.S. Department of Energy's (DOE) long running minority educational research program.

The DOE awards - presented under the Historically Black Colleges and Universities and Other Minority Institutions (HBCU/OMIs) program - are $200,000 each for projects that will address high-performance materials for long-term fossil energy applications, such as advanced ultrasupercritical combustion (AUSC), oxygen-fired combustion, gasification, and hydrogen turbines. The projects, each three years in duration, will use computational or experimental methods, or a combination of both, to conduct the investigations. Due to the Program's Fiscal Year 2012 funding availability, only the top four scoring applications were able to be selected.

In existence for 28 years, HBCU/OMI is managed by the Office of Fossil Energy's (FE) National Energy Technology Laboratory and focuses on three core research areas: sensors and controls, computational energy sciences, and advanced materials. The three topics and projects to be studied under this year's program include:

Surface Modification of Alloys for AUSC Coal-Fired Boilers/Steam Turbines and Gas Turbines
This project will develop new surface modification techniques, or improve existing ones, for the protection of high-temperature alloys used in AUSC coal-fired boilers and in advanced gas turbines.

- **University of Texas at El Paso** (El Paso, Texas)--The high-temperature environments of AUSC coal-fired boilers and steam and gas turbines require corrosion-resistant coatings with enhanced thermal durability and reliability. A technique for applying coatings is thermal spraying, in which heated or melted materials are sprayed onto the intended surface. The University of Texas at El Paso intend to develop advanced coatings and alloys that will have high-temperature creep properties and high-temperature oxidation and corrosion resistance.

Structural Materials
This project will focus on the development of structural materials for the high temperature and high pressures (760°C and 5000 psi and higher) of AUSC coal-fired power systems and high temperatures (above 1700°C) of advanced gas turbines.

- **Southern University and A&M College** (Baton Rouge, La.)--Southern University and A&M College will partner with Louisiana State University to develop and experimentally validate a novel integrated method of designing ferritic (iron-chromium-aluminum) oxide dispersion-strengthened (ODS) steel alloys for use in high-temperature, high-pressure turbines. Ferritic ODS steel alloys show promise as having higher operating temperatures (up to 1200°C) and major improvements in high-temperature creep and oxidation resistance.

Materials Processing

The more severe operating environments (temperature, pressure and corrosivity) and performance specifications of advanced fossil energy systems require increasingly complex structural and functional materials. These projects will investigate techniques for processing materials for advanced power generation technologies that will ensure they meet the required performance criteria.

- **University of Texas at El Paso** (El Paso, Texas)--Materials based on molybdenum disilicide (MoSi2) show promise for structural applications in the extreme operating conditions of advanced boilers and steam and gas turbines. MoSi2 has properties such as a high melting point and excellent high-temperature oxidation resistance that make it useful in oxidizing environments at temperatures significantly above 1100°C. However, low fracture toughness at room temperature and low strength at extremely high temperatures hinder the widespread use of MoSi2 in structural applications. The University of Texas at El Paso will develop a novel and competitive process for manufacturing MoSi2-based composites that are dense, low-porous materials of various shapes for structural applications in advanced fossil fuel power plants. University of Texas at El Paso (El Paso, Texas)--The increasing use of coal by either direct combustion or conversion into gaseous or liquid fuels creates the need for materials resistant to oxidation, sulfidation and carburization, as well as the capability to process protective scales which are applied or form in situ during coal gasification. The objective of this proposal is to investigate computationally the plasma (gas-like) processing of carbide scales used as thermal barrier coatings or for ceramic composites. The outcome of the work will be understanding plasma processing of nonmetallic packed beds sufficiently to develop materials for the extreme temperatures found in advanced fossil fuel energy systems.