



NETL COLLABORATION PRODUCES SMART SENSORS TO MONITOR ULTRA-HIGH TEMPERATURE ENERGY SYSTEMS

February 19, 2019

Developing turbines and other advanced energy systems that can operate at extremely high temperatures boosts efficiency, thereby cutting operating costs and offering potential savings for consumers. Monitoring is critical to ensure that these complex systems run safely and effectively, with minimal downtime; however, the necessary ultra-high temperatures also introduce challenges in developing sensors that can withstand such harsh environments.

A recently completed NETL-managed project with Colorado-based Sporian Microsystems, Inc., produced smart temperature sensors that can operate up to 1800 degrees Celsius as well as pressure sensors that operate at temperatures up to 1600 degrees Celsius for improved performance in monitoring gas turbines, combustion systems and more. Extensive testing in relevant environments shows that the developed sensors offer the potential for greater durability, functionality and reliability at a more affordable price than existing alternatives.

Existing sensors used to monitor advanced power systems are expensive and have poor life spans under ultra-high temperature conditions. Sporian's sensor technology is made from novel polymer-derived ceramic materials, which offer unique advantages that enhance performance and thermal stability, and incorporates smart functionality for about half the cost. The temperature and dynamic pressure sensors developed by Sporian through this research effort feature pioneering innovations in

More Stories

[NETL Highlights Its Research at Premier Society of Petroleum Engineers' Event in Texas](#)

[NETL Director Brian Anderson Highlights Lab's Research at National Coal Council Meeting](#)

[Computational Modeling Accelerates Efforts to Improve SOFC Performance](#)

[Office of Fossil Energy Officials Share](#)

materials development, manufacturing processes and advanced packaging technologies.

NETL assisted with testing of sensor prototypes in relevant environments, offering specialized [aerothermal rig testing](#) in a simulated combustion environment to help Sporian advance toward increasingly higher temperatures and tests in real-life energy systems. Sensors were also tested at [Southwest Research Institute's](#) Pressurized High-Temperature Flow Facility. In addition, Sporian is looking forward to collaborating with the [Air Force Research Laboratory](#) on a follow-on demonstration of the sensor technology under full engine conditions. Other collaborators for this testing effort include the [Ohio Aerospace Institute](#) and [Propulsion Instrumentation Working Group](#).

Sporian's ultra-high temperature smart sensor technology offers opportunities to stimulate economic investment through other applications, such as engine and aerospace systems development. Sporian is working with gas turbine manufacturers, utility companies, research organizations and others to explore commercialization possibilities.

The U.S. Department of Energy (DOE) devoted \$2.1 million to Sporian's latest sensing project, which began in June 2012 and evolved from previous awards under DOE's Small Business Innovation Research (SBIR) program in association with NETL's [Crosscutting Research Program](#). Sporian's initial research collaboration with DOE began about 15 years ago and has spawned nearly 20 additional projects with federal and private partners to investigate innovative high-temperature technologies. DOE investments managed by NETL facilitate the fundamental research necessary to advance emerging technologies for commercialization and promote long-term economic growth.

Advanced sensing systems are essential to achieving the cost and performance targets of future energy systems. The ultra-high-temperature smart sensor technology developed in collaboration with NETL offers the potential to enhance gas turbines, combustion systems and other critical equipment by ensuring access to safe, affordable and efficient homegrown energy that meets America's needs.

To learn more about NETL's sensors and controls work, click [here](#).

[Office of Fossil Energy Officials Share Clean-Coal Advances at Pittsburgh Conference](#)

[NETL Aids Hurricane Dorian Response Efforts](#)

[NETL Highlights 200-Plus Research Projects Aimed at Addressing US Energy Needs](#)

[NETL-Developed Digital Suite Prevents and Predicts Oil Spills](#)

[NETL Regional Workforce Initiative to Present Ethane Storage and Distribution Hub Webinar Sept. 12](#)

[NETL Shares Success of Pittsburgh Partnership with Energy Experts from Japan](#)

[eXtremeMAT Technical Advisory Board Discusses Development of Extreme Environment Materials for Fossil Fuel Plants at NETL](#)
