PROJECT facts

U.S. DEPARTMENT OF ENERGY
OFFICE OF FOSSIL ENERGY
NATIONAL ENERGY TECHNOLOGY LABORATORY

Advanced Research

09/2004

NEW OPTICAL SENSOR SUITE FOR ULTRAHIGH TEMPERATURE FOSSIL FUEL APPLICATIONS

Description

Current fossil fueled steam power plant performance is limited by a number of factors, especially the lack of sensors in various components that could be used for real-time local condition monitoring and closed-loop control. The critical factor limiting the availability of these sensors is typically that no sensor materials are able to withstand the high-temperature, high-pressure, corrosive/erosive environments found within these components.

The goal of the program is to enable revolutionary improvement in the efficiency and output of fossil fueled power plants through introduction of new control systems based on a suite of photonic sensors that are able to operate at ultrahigh temperatures. Building on prior experience in the development of fiber optic sensors for harsh environments, Prime Research LC has teamed with Babcock & Wilcox and the Virginia Tech Center for Photonics Technology to extend the reach of harsh environment fiber optic sensor technology into this ultrahigh temperature.

Cross-section of ceramic clad sapphire fiber for ultrahigh-temperature photonic sensors.

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PROJECT COST

Total Cost
$984,181

PROJECT DURATION

10/01/2001 -09/30/2004

WEBSITES

www.netl.doe.gov/coal

Objectives

The key research objectives involve the development of new processing methods to produce the ultrahigh-temperature clad sapphire fiber, and the demonstration of new, ultrahigh-temperature photonic sensors for fossil fuel power plants. The program will focus on the following:

- Identification of all the applications within a next-generation fossil fuel power generation plant where ultrahigh temperature sensors are needed,
- Identification of sensors most applicable in each location within the facility,
- Development of a reproducible process for creating chemically modified sapphire fiber to be used in the fabrication of the sensors, and
- Demonstration of success through laboratory and field measurements at ultrahigh temperatures.