the ENERGY lab

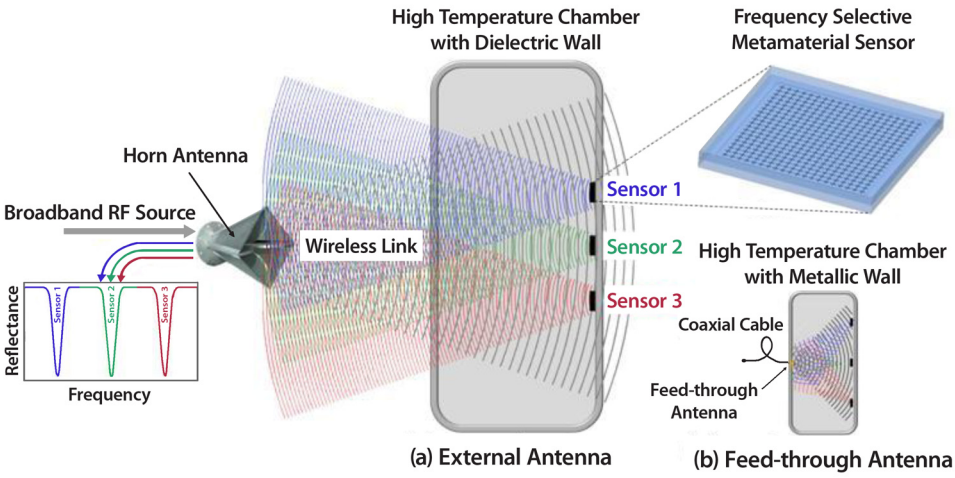
PROJECT FACTS

Advanced Research

Ultrahigh-Temperature Distributed Wireless Sensors

Description

The U.S. Department of Energy (DOE) National Energy Technology Laboratory (NETL) is working in cooperation with Prime Research, LC (PRLC) and the Virginia Tech Antenna Group (VTAG) to develop a wireless sensor capable of operating at extreme temperatures and in highly corrosive environments. Not only will this technology eliminate the need for cables connected to the sensors, in many cases, it will reduce the need to machine pathways to gain access into plant interiors. The technology is enabled by recent developments in radio frequency identification, high temperature materials, and frequency selective metamaterials, and has the potential to transform the way sensing is performed in harsh environments.



Novel wireless sensors using radio frequency identification will allow measurement of temperature and pressure in harsh high-temperature environments.

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PERIOD OF PERFORMANCE

10/01/2009 to 09/30/2012

COST

Total Project Value
$810,954

DOE/Non-DOE Share
$648,763 / $162,191

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U.S. DEPARTMENT OF ENERGY

Goals and Objectives

The goal of the project is to develop and demonstrate a robust and accurate wireless sensing technology for use at extreme temperatures and in highly corrosive environments. The main objectives of the project are (1) to better understand the radio frequency environment in which the system will operate and the electromagnetic properties of the materials to be used; (2) identify frequency bands where wireless sensing is feasible; (3) identify an optimum electromagnetic design for the sensors; (4) fabricate the wireless sensors; and (5) test the sensors and their packaging.

Technological Approach

PRLC and VTAG will carry out a comprehensive effort to develop a wireless sensor suitable for operating at extreme temperatures up to 1600 °C and in highly corrosive environments. Work will entail characterizing the radio frequency environment and the materials to be used, developing a suitable wireless sensor, and demonstrating the system in a representative environment. PRLC will provide expertise for design and packaging of the sensors. VTAG will provide expertise for characterization of the environment and materials, as well as testing prototype devices. The program has been divided into two phases to provide a convenient go/no-go decision point. The first phase will include obtaining a better understanding of the environment and materials for radio wave propagation and creating a detailed design of the wireless sensors. The second phase will consist of experimental validation at low temperature followed by finalization of the sensor design and testing in a realistic environment.

Benefits

The proposed ultrahigh-temperature wireless sensing technology will offer many significant advantages over other approaches. These include enhanced reliability, simplified installation, improved accuracy, and increased durability. More accurate and reliable sensors in gasification may increase efficiency and decrease required maintenance time and cost. The wireless sensors may be adapted for use in other processes involving extreme environments.