

TECHBRIEF

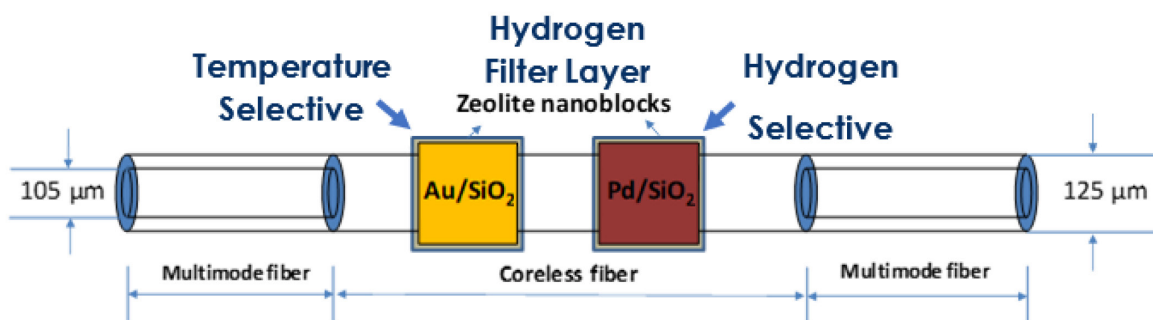
LOW-COST OPTICAL SENSOR ARRAY TO MONITOR TEMPERATURE AND DISSOLVED GASES IN ELECTRICAL ASSETS

OPPORTUNITY:

The invention is a new low-cost way to form an optical sensor array that monitors multiple parameters such as temperature and hydrogen in essential components of electrical transmission and distribution networks. It uses multi-wavelength interrogation combined with multiple sensor elements using a single optical fiber. This technology is available for licensing and/or further collaborative research from the U.S. Department of Energy's National Energy Technology Laboratory.

CHALLENGE:

Power transformers are among the most essential components of electrical transmission and distribution networks. To avoid the substantial financial and social expenses caused by catastrophic failures, there is a growing need to develop low-cost and real-time analytical techniques and instruments to detect and diagnose fundamental changes in the operating characteristics of transformers. Key parameters, such as dissolved gases content and temperature, provide valuable information for assessing the condition of transformers. For example, dissolved gas analysis (DGA) identifies electrical or thermal faults in transformers. In addition, temperature information is vital because when the temperature in transformers exceeds 90° C, the aging rate of insulation and tensile strength grows, resulting in a dramatic deterioration of transformer life expectancy. It is therefore of significant value to monitor the temperature under various ambient and loading conditions to identify failures before they result in significant damages.



Schematic diagram of the sensor structure.

(continued)



FOR MORE INFORMATION:

Agreements:
TTAgreements@NETL.DOE.gov

Licensing:
TTLicensing@NETL.DOE.gov

Customer Service:
1.800.553.7681

626 Cochran Mill Road
Pittsburgh, PA 15236
412.386.4984 (receptionist)

3610 Collins Ferry Road
Morgantown, WV 26505
304.285.4764 (receptionist)

1450 Queen Avenue SW
Albany, OR 97321
541.967.5892 (receptionist)

OVERVIEW:

NETL researchers have discovered system and method for a low-cost optical fiber sensor array that monitors multiple parameters using multi-wavelength interrogation combined with multiple sensor elements along a single optical fiber. The sensor array includes an optical fiber, and nanocomposite thin films along portions of the optical fiber for interrogating parameters with different wavelengths.

ADVANTAGES:

Conventional optical fiber-based temperature sensors and most commercial sensors for transformer monitoring cost thousands of dollars. The NETL technology, using multiplexing capabilities of fiber optic sensors, enables monitoring of multiple sensing points with a single interrogation unit, saving money and time. The current state of the industry needs sensors for electrical transmission, distribution networks, and other electrical grid assets to monitor asset health.

APPLICATIONS:

The development and commercialization of cost-effective optical sensor arrays that monitor multiple parameters, such as temperature and hydrogen, can have a critical impact on the cost effectiveness of keeping electrical components important to serving the nation's power needs. The technology can be applied effectively for incorporation into transformers and other essential components of electrical transmission and distribution networks where expensive equipment failure could occur due to undetected high temperatures and/or high levels of hydrogen.

PATENT STATUS:

U.S. Patent No: 11,268,984

Issued: 03/08/2022

Title: Low-Cost Fiber Optic Sensor Array for Simultaneous Detection of Multiple Parameters

Inventors: Chenhu Sun, Ping Lu, Ruishu Wright, Paul R. Ohodnicki

NETL Reference No: 18N-21