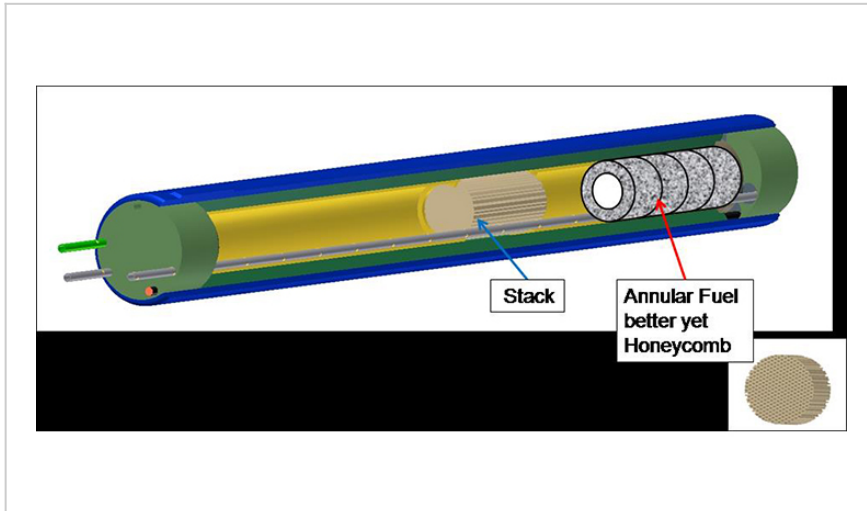


# Thermoacoustic Enhancements for Nuclear Fuel Rods

ID# 2012-3960



Annular Fuel Enhances TAC Heat Transfer

## Technology Summary

The introduction of a self-powered thermoacoustic sound source into a nuclear fuel rod provides the ability to sense the condition of a nuclear reactor or spent fuel without needing electrical power for either the sensor or the telemetry of sensor information. (When the Fukushima reactors lost power they had no way to assess the temperature within the reactors or the spent fuel ponds.) In addition, the standing sound wave created thermoacoustically enhances the transfer of heat from the fuel to the water.

## Application & Market Utility

The interior of a nuclear reactor presents a harsh environment for sensors and telemetry due to high temperatures and fluxes of energetic and ionizing particles among the radioactive decay products. The disclosed invention uses materials immune to these effects to create a self-powered temperature sensor providing reactor performance information even when external electrical power is unavailable. The sensor's form-factor is identical to current fuel rods. Utility could be extended to remotely sense changes in fuel porosity and to track the evolution of fission gases.

## Next Steps

Scale model verified; seeking licensing opportunities.

TECHNOLOGY READINESS LEVEL

4-7

### Seeking

Investment | Licensing | Research

### Keywords

- thermoacoustics
- sensors
- thermometry
- engines
- nuclear Fuel

### Researchers

#### Steven L. Garrett

Professor of Acoustics, Senior Scientist of ARL  
[Online Bio](#)

#### James A. Smith

Characterization Systems Engineer

#### Dale K. Kotter

Characterization Systems Engineer

#### Originating College

ARL

#### Office of Technology Management Contact

Swope, Bradley  
bas101@psu.edu  
814-863-5987