Thermoacoustic Enhancements for Nuclear **Fuel Rods** ID# 2012-3960



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

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 themoacoustically 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 selfpowered 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.



Invent Penn State is a Commonwealth-wide initiative to spur economic development, job creation, and student career success. Invent Penn State blends entrepreneurship-focused academic programs, business startup training and incubation, funding for commercialization, and university-community collaborations to facilitate the challenging process of turning research discoveries into valuable products and services that can benefit Pennsylvanians and humankind. Learn more at invent.psu.edu.

Penn State is an equal opportunity, affirmative action employer, and is committed to providing employment opportunities to all qualified applicants without regard to race, color, religion, age, sex, sexual orientation, gender identity, national origin, disability or protected veteran status.

