PENN CENTER FOR INNOVATION

High-Performance Ceramic Anodes for Solid Oxide Fuel Cells

Inventor
Dr. Ray Gorte

STATE OF DEVELOPMENT
- Laboratory prototype

ADVANTAGES
- Lower temperature operation (<800C)
- Thermal stability and redox stability
- Compatible with commercial fuels (gasoline, diesel, jet fuel)

INTELLECTUAL PROPERTY
- US Patent 8,021,799

REFERENCE MEDIA
- Gross et al. (2007). A strategy for achieving high performance with SOFC ceramic anodes. Electrochemical and solid-state letters.

DESIRED PARTNERSHIPS
- License

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Ryne DuBose
rdubose@upenn.edu
215-746-8107

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Problem
Solid Oxide Fuel Cells (SOFCs) generate electricity by oxidizing hydrocarbon fuels at high temperatures. Most SOFCs have anodes made from cermets (ceramic-metal composites), usually mixtures of nickel and ceramics such as yttria-stabilized zirconia (YSZ). However, these anodes perform poorly with fuels that contain sulfur, such as gasoline, diesel, and jet fuel. Other metallic anodes have poor thermal stability or do not tolerate oxidation well. Anodes with improved performance would make it easier to use SOFCs with commonly-available commercial fuels.

Solution
Researchers at the University of Pennsylvania have developed high-performance SOFC ceramic anodes with improved electrocatalytic activity and redox stability for use with hydrocarbon fuels. These anodes provide high fuel efficiency and high cell power density at operating temperatures less than 800C. This design features a thin functional layer and a thick conduction layer, allowing materials in each layer to be optimized independently. This produces a thermally stable and redox-stable anode due to the low metal content, compatible with sulfur-containing fuels.