Highly Efficient, Durable Cathodes for Solid Oxide Fuel Cells (SOFCs) (#7256)

Facilitates fuel cell performance across a broad temperature spectrum

This technology was developed to provide faster oxygen-reduction reactions (ORR) in solid oxide fuel cells (SOFCs) while maintaining durability. It dramatically enhances ORR kinetics and stability of current lanthanum strontium cobalt ferrite (LSCF) cathodes by applying an efficient electro-catalyst coating derived from a low-cost, one-step infiltration process. The coating is a conformal perovskite nickel manganese (PNM) film and highly active praseodymium oxide nanoparticles exsoluted from the PNM film. The nanoparticles exhibit high oxygen vacancy concentrations that facilitate rapid ORR kinetics. The PNM film provides rapid oxygen ion transport to the LSCF surface and, in addition, enhances the stability of the cathode.

This well-designed approach to introducing a thin catalyst on a cathode backbone provides high performance and excellent stability and facilitates improved SOFC performance across a broad temperature spectrum.

Benefits/Advantages

- **More stable**: The technique used enhances cathode durability while maintaining the high-kinetic electrode structure
- **Stackable**: The cathode design is suitable for implementation in a fuel cell stack
- **Fast**: The combination of nanoparticles and conformal coatings provides increased reaction sites and rapid transport paths

Potential Commercial Applications

- Solid oxide fuel cells
- Distributed energy generation
- Energy conversion
- Energy storage
- Electrolysis cells

Background/Context for This Invention

Solid oxide fuel cells offer clean and efficient energy generation; however, their adoption is hindered by limited lifetime and high cost to fabricate and operate. One way to lower their cost is to enhance the ORR, particularly at lower temperature. Resistance during ORR contributes the most to energy loss in current

SOFCs, and the problem is more pronounced at lower temperatures. The Georgia Tech innovation addresses these issues.

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More Information

U.S. Application Filed - US20190140287A1

International Application Filed - WO2017189531A1

Publications

A Robust and Active Hybrid Catalyst for Facile Oxygen Reduction in Solid Oxide Fuel Cells, Energy and Environmental Science, March 14, 2017

A Highly Efficient Multi-phase Catalyst Dramatically Enhances the Rate of Oxygen Reduction
, Joule, March 1, 2018

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/highly-efficient-durable-cathodes-solid-oxide-fuel-cells-sofcs

Images:

The automated sequential delivery of multiple fluids. A varying number of delay gates imprinted in the branches are shown in the figure.

COVID-19 and flu saliva test on paper: (A) The automatic sequential delivery of multiple reagents required for virus test; (B) Water pouring into the device triggers the virus assay, allowing the presence of SARS-CoV-2 and influenza A & B viruses to be visually identified by the color changes in the corresponding detection spot