A Ni-YSZ Composite Anode (#4673)

A Ni-YSZ anode that can be used to produce structures that have high electrical conductivity

Georgia Tech researchers have developed a Ni-YSZ anode that can be used to produce structures that have high electrical conductivity at relatively low temperatures and chemical and thermal stability over a wide range of conditions. The composition allows for the rapid transport of protons and oxide ion vacancies, which gives the structure (e.g., in a fuel cell) a distinct advantage by allowing the structure to supply and take up water thereby using less steam. The content of the composition can be modified so that the structure is an anode or a cathode and/or so the structure has certain characteristics (e.g., catalytic, high ionic, proton, and/or electron conductivity, chemical stability, and/or thermal stability, and the like).

Benefits/Advantages

- **Sustainability —** allows the solid oxide fuel cell to use less steam in the reformation of carbon-containing fuels
- **Compatibility —** compatible with components of current SOFCs systems

Potential Commercial Applications

- Carbon buildup reduction
- Reduction and prevention of sulfur poisoning
- Fuel cells

Background/Context for This Invention

Unlike polymer electrolyte fuel cells, solid-oxide fuel cells (SOFCs) can use a wide variety of hydrocarbon fuels. Because of their high operating temperatures, metal catalysts added to the ceramic anodes can facilitate reforming reactions from hydrocarbons. The conventional anode for an SOFC has excellent catalytic activity for fuel oxidation, good conductivity for current collection, and unmatched compatibility with YSZ electrolytes for easy cell fabrication, but it is highly susceptible to carbon buildup (coking) and deactivation (poisoning) by contaminants commonly encountered in readily available fuels. Some contaminants can dramatically degrade its performance even at parts per million (ppm) levels. Sulfur adsorbs strongly on Ni surface and thus blocks the active sites for electrochemical oxidation of fuel, resulting in considerably increased anodic polarization and energy loss.

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More Information

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Publications

For more information about this technology, please visit:
https://licensing.research.gatech.edu/technology/ni-ysz-composite-anode

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