



TECH TO BUSINESS

CONTACT: ipm@innovatecalgary.com | 403.284.6400

High Performance Materials for Reversible Solid Oxide Fuel Cells

TECH ID #: 284.23

Background

Researchers at the University of Calgary have developed a new $\text{La}_{0.3}\text{Ca}_{0.7}\text{Cr}_{0.3}\text{Fe}_{0.7}\text{O}_{3-\delta}$ mixed-conducting perovskite oxide as an oxygen and fuel electrode for reversible solid oxide fuel cells. The material has been found to be excellent for reversible symmetrical fuel cells, working very well as oxygen and fuel electrode in both fuel cell and electrolysis mode. The concept of using a single material for oxygen reduction and CO/H_2 oxidation (fuel cell), and in reverse, for oxygen evolution and CO_2 reduction (electrolysis, energy storage), has been demonstrated and would lead to simplified stack manufacturing with reduced cost.

Areas of Application

- Reversible solid oxide fuel cell manufacture
- High performance oxygen and fuel electrode material
- Novel synthetic method for catalyst fabrication

Competitive Advantages

- Symmetrical electrode material provides greater manufacturing flexibility
- Stable air electrode that is resistant to delamination from the electrolyte during electrolysis mode
- Sulfur tolerant electrode material
- Optimized synthesis method which increases electrode performance and decreases the processing time has been demonstrated

Stage of Development

- High-purity perovskite oxide powders were prepared using combustion and microwave-assisted methods
- Symmetrical electrolyte supported cells were fabricated
- The material was tested as an oxygen and fuel electrode in fuel cell and electrolysis modes
- Button cells were operated for 100 h with little change in performance and no interfacial damage



Intellectual Property Status

- US provisional patent application filed

Publications

- “Microwave-assisted synthesis and characterization of new cathodic material for solid oxide fuel cells: $\text{La}_{0.3}\text{Ca}_{0.7}\text{Cr}_{0.3}\text{Fe}_{0.7}\text{O}_{3-\delta}$ ” *Ceram. Int.* **2015**, *41*, 8411-13
- “High performance $\text{La}_{0.3}\text{Ca}_{0.7}\text{Cr}_{0.3}\text{Fe}_{0.7}\text{O}_{3-\delta}$ air electrode for reversible solid oxide fuel cell applications” *Int. J. Hydrogen Energy* **2015**, *30*, 1902-1910