NREL Highlights
RESEARCH & DEVELOPMENT

NREL Team Creates High-Activity, Durable Platinum Extended Surface Catalyst for Fuel Cells

Breakthrough in platinum structures maintains high catalytic activity and could lead to reduced costs for hydrogen fuel cells, which hold the promise of powering vehicles and buildings.

Hydrogen fuel cells could power the vehicles of tomorrow. With platinum an essential catalyst in fuel cells—and selling for more than $1,500 per ounce—reducing platinum loading while maintaining performance and durability is a particular challenge.

Researchers with the National Renewable Energy Laboratory's (NREL) Fuel Cell Team have demonstrated several extended surface platinum catalysts made through galvanic displacement of metal nanowires. The process has resulted in high-surface-area and high-specific-activity catalysts that have shown good durability under potential cycling conditions.

The NREL Fuel Cell Team starts with nanowires of copper or silver 50 to 250 nanometers wide—in comparison, a human hair is about 60,000 nanometers in diameter—and usually several microns in length. That's tiny, but it represents a much larger structure than conventional fuel cell catalysts, which are 2 to 5 nanometers in diameter. This approach improves electrical conductivity while maintaining a relatively high surface area.

The U. S. Department of Energy (DOE) target for specific activity of a fuel cell catalyst is 0.72 milliamps per square centimeter (mA/cm^2) of platinum at 0.9 volts. NREL has improved that target and obtained several samples above 1.0 mA/cm^2 of platinum at 0.9 volts. And NREL has demonstrated surface areas of 30 square meters per gram (m^2/g), whereas other similar structures tend to reach only 10 m^2/g.

The University of California Riverside is a project collaborator in these efforts.

Key Research Results

Achievement

NREL synthesized extended surface platinum using nanowires to produce novel fuel cell catalysts that could be useful in hydrogen fuel cells while sharply driving down the cost compared to an all-platinum catalyst.

Result

NREL's new extended surface catalysts have exceeded the DOE target for specific activity per surface area for a fuel cell catalyst.

Potential Impact

Higher-performance, lower-cost catalysts with improved durability and tolerance will further speed the commercialization of fuel cells for light-duty transportation.

NREL
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NREL is a national laboratory of the U.S. Department of Energy, Office of Energy Efficiency and Renewable Energy, operated by the Alliance for Sustainable Energy, LLC.

NREL/FS-5600-50848 • February 2011

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