

Improved Fuel Cell Cathode Catalysts Using Combinatorial Methods

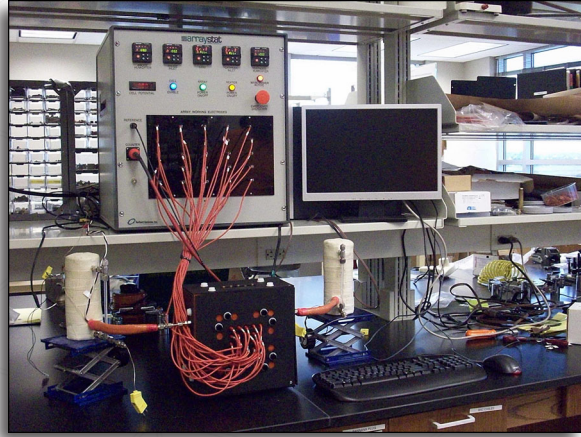
New Test Equipment Allows Rapid Testing of Fuel Cell Components

Platinum is currently used as a catalyst in fuel cell membrane electrode assemblies (MEAs). Unfortunately, platinum is an expensive precious metal and its use increases the overall cost of a fuel cell. Reducing the amount of platinum or substituting alternative materials requires time-consuming ex situ methods of analysis that do not consider the effects of the realistic catalyst environment and flowing reactant fuel and oxidant streams. A device is needed that evaluates the catalyst as it is incorporated into a real MEA in an operating fuel cell.

NuVant Systems, Inc., with a U.S. Department of Energy Small Business Innovation Research (SBIR) grant, developed testing equipment that eliminates the need for multiple test stations and provides a convenient way to test MEAs realistically and rapidly. The Arraystat™ requires only one pair of mass flow controllers and a single operator to run the equivalent of 25 single-cell test stations. In addition, a separate parallel array fuel cell test fixture allows a membrane to be screened in an actual fuel cell environment. NuVant's patented technology uses an array MEA. The counter electrode of the array MEA consists of a single large area standard fuel cell electrode, while the array side consists of a library of 25 catalyzed spots. Each spot consists of a user-supplied gas-diffusion-layer disc that is catalyzed by the end user's method and is attached to the membrane. The assembly is then housed in the patented array fuel cell through which fuels and oxidants are delivered. The completed assembly may then be connected to the Arraystat, which can be routed to a computer using the associated software to gather and analyze the data. The Arraystat individually addresses each electrode disc. This method allows for the preparation and testing of various MEAs with high throughput under realistic catalyst loadings and reactant flow rates.



NuVant's Array Potentiostat (Arraystat) and Parallel Array Flow-Field Fuel Cell



NuVant's Array Potentiostat (Arraystat) Connected to Parallel Array Fuel Cell

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Technology History

- ▶ Research started in 2004.
- ▶ Sold first commercial Arraystat in 2006 and sold the first commercial parallel array fuel cell in 2007.

Applications

Can be used to test MEAs using different combinations of catalysts as well as flow-field design, MEA degradation, parallel battery charge-discharge characteristics, and optimized plating conditions.

Capabilities

- ▶ Measures and records data from 25 separate locations.
- ▶ Achieves high throughput through modular design.
- ▶ Allows MEA component or flow-field evaluation.

Benefits

Accuracy

Eliminates random error introduced by multiple test stands because a single common counter electrode is used.

Cost Savings

Reduces costs associated with testing MEAs because of the high throughput and single test station.

Versatility

Allows maximum flexibility by having user defined measurement discs.

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