



Apparatus for Screening Multiple Oxygen-Reduction Catalysts

Multiple specimens are tested simultaneously at equal potential in the same solution.

NASA's Jet Propulsion Laboratory, Pasadena, California

An apparatus that includes an array of multiple electrodes has been invented as a means of simultaneously testing multiple materials for their utility as oxygen-reduction catalysts in fuel cells. The apparatus ensures comparability of test results by exposing all the catalyst-material specimens to the same electrolytic test solution at the same potential. Heretofore, it has been possible to test only one specimen at a time, using a precise rotating disk electrode that provides a controlled flux of solution to the surface of the specimen.

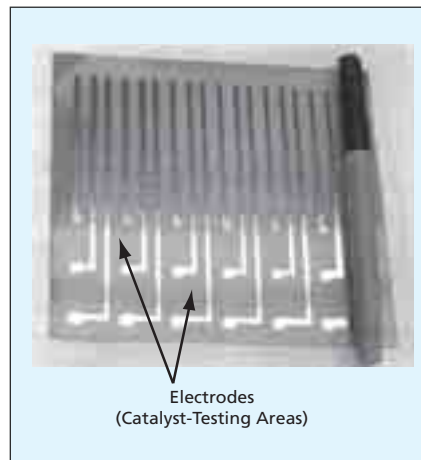
For each set of catalytic materials to be tested, the electrodes and their current collectors (see figure) are fabricated as gold-film patterns on a flexible poly(vinylidene fluoride) substrate that is typically a fraction of a millimeter thick. The electrode areas measure 5 by 5 mm. The electrode areas are coated with thin films of the catalytic materials to be tested. The chemical compositions of these films are established in a combinatorial deposition process: The films are sputter-deposited simultaneously onto all the electrodes from targets made of different materials at different positions relative to the array. Hence, the composition of the deposit on each electrode is unique, dependent on its position. The composition gradi-

ent across the area of the array and, hence, the variations among compositions of deposits on the electrodes, can be tailored by adjusting the target/substrate geometry and the relative target powers.

The resulting flexible electrode fixture is placed on the inside wall of a 20-cm-diameter vertical cylindrical container with the electrodes facing inward. The current collectors are connected to the input terminals of a multichannel potentiostat. The container is filled with electrolyte solution. In operation, oxygen is bubbled through the solution and the solution is stirred rapidly (e.g., by use of a conventional propeller/impeller or a magnetic stirrer) to maintain a laminar flow of consistently oxygenated solution over the electrodes. During operation, the multichannel potentiostat simultaneously measures the currents generated at all the electrodes as functions of an applied bias voltage. Typically, the voltage is varied in a slow potentiodynamic scan.

This work was done by Jay Whitacre and Sekharipuram Narayanan of Caltech for NASA's Jet Propulsion Laboratory. Further information is contained in a TSP (see page 1).

In accordance with Public Law 96-517, the contractor has elected to retain title to this



This Array of Eighteen Gold Electrodes and current collectors was fabricated on a 0.5-mm-thick PVDF sheet. Each electrode is coated with a different catalytic material to be tested.

invention. Inquiries concerning rights for its commercial use should be addressed to:

*Innovative Technology Assets Management
JPL*

Mail Stop 202-233

4800 Oak Grove Drive

Pasadena, CA 91109-8099

(818) 354-2240

E-mail: iaoffice@jpl.nasa.gov

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Determining Aliasing in Isolated Signal Conditioning Modules

Input anti-aliasing filters eliminate rogue frequencies that cause aliasing.

Dataforth Corporation, Tucson, Arizona

Within a digital world, the parameters of real-world information (temperature, voltage, current, speed, flow, pressure, distance, etc.) used for process communications and control are analog in nature. Processing this information is achieved primarily using digital signal processing techniques. The age of microelectronics has made it possible for digital processing power to be extended into the field where sensors are located; thus, much preprocess-

ing can be accomplished outside the main computer or PC.

There are many issues that can create serious problems along the way, such as EMI noise, grounding, accuracy, resolution, aging, drift, isolation, and noisy power supplies. In addition, there is one very subtle problem that often goes unnoticed but can lurk in the background. Known as aliasing, this problem exists in isolated signal conditioning modules

(SCMs) and anywhere an analog-to-digital converter is active.

The basic concept of aliasing is this: Converting analog data into digital data requires sampling the signal at a specific rate, known as the sampling frequency. The result of this conversion process is a new function, which is a sequence of digital samples. This new function has a frequency spectrum, which contains all the frequency com-