High Temperature Membrane Working Group

Meeting Minutes — Thursday, October 16, 2008 — Honolulu, Hawaii

The semi-annual meeting of the HTMWG was held at the Hilton Hawaiian Village in conjunction with the Pacific Rim Meeting on Electrochemical and Solid-State Science (PRIME). Participants were welcomed by John Kopasz, representing the Department of Energy. After welcoming everyone, he went on to remind everyone of the upcoming Go/No Go milestone at the end of December.

Following the welcome, James Fenton from the University of Central Florida/Florida Solar Energy Center, commented on the excellent talks being given at PRIME. Dr. Fenton noted that the HTMWG meeting organizers had taken advantage of being halfway to Japan by asking Shyam Kocha from Nissan to give an overview of the automotive company's approach to performance measurements of membrane electrode assemblies (MEAs).

Dr. Kocha began with a discussion of the issues involved in measuring the performance of an MEA. Determining the electrochemically active area depends upon the nitrogen flow rate at the cathode, the cell temperature and cell relative humidity (RH). A high nitrogen flow shifts the H_2 onset towards positive potentials, leading to a smearing of the H_{ads} peaks. A zero nitrogen flow rate is recommended for ECA diagnostics.

In determining the temperature at which to run a cell for cyclic voltammetry diagnostics, a high temperature is recommended for measuring the amount of hydrogen but to get the surface area of platinum, a low temperature should be used. With regard to the RH of a cell, research has shown that the onset of oxide formation shifts positively as RH decreases.

Dr. Kocha went on to explain that there is significant scatter of data in the literature with regard to ORR activity. The reasons for this scatter can be the catalyst loading, surface area, operating conditions and the protocol used. He went on to discuss a number of measurement protocols and the effect of each.

To conclude his talk, Dr. Kocha reported on the current status of fuel cell stacks and gave an overview of requirements and testing.

The next speaker was Bryan Pivovar from the National Renewable Energy Lab. Dr. Pivovar presented a discussion on improved membranes for high temperature fuel cells. He said that there are three strategies in membrane research: phase segregation control, non-aqueous proton conductors and hydrophilic additives. He said that there are tunable parameters that can influence the transport properties. These tunable parameters include backbone characteristics, acid group characteristics, ion exchange capacity and the processing/history. Each of these tunable parameters and the resulting influence was covered in detail.

Dr. Pivovar concluded his talk with a discussion of the mechanical/swelling problems of high temperature materials and some suggestions for dealing with these problems.

The final speaker was Marianne Rodgers from UCF/FSEC who gave a presentation on FSEC's MEA Test Protocol. The talk included the goals of the testing, the components to be used, and an overview of the daily test sequence. She concluded with an example of the kind of data that would be provided for each test.

Of the three talks, this final one garnered the most discussion. An initial question was whether enough data had been generated to demonstrate reproducibility. Dr. Fenton, as PI of this particular project, stepped in to answer the questions. He said that the presentation was intended to begin a dialog on how the testing should be conducted. A number of tests had been run but it was anticipated that many more would need to be run before MEAs from the HTMWG members could be tested. Additional questions were raised regarding how all of the MEAs could be prepared according to a single protocol when the membranes are not all the same. Dr. Fenton assured the audience that the goal is for FSEC to work closely with the team members to determine how each membrane should be handled. An audience member observed that preparing the MEAs could turn into a research project of its own. Dr. Fenton agreed that this would be a difficulty but that FSEC would attempt to balance the need for customizing the MEA preparation with doing the task in a timely manner and in such a way as to allow comparison of the merits of the different samples.

The meeting concluded with Dr. Fenton pledging to work closely with the other team members to ensure the best possible results.