V.A.5 Component Benchmarking – Subtask Reported: USFCC Durability Protocol Development and Technical-Assisted Industrial and University Partners

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Project End Date: Project continuation and direction determined annually by DOE

Objectives

- Technically assist fuel cell component and system developers.
- Test and characterize materials and components and provide feedback to developers.
- Validate and compare single cell test protocols (Japan Automobile Research Institute [JARI], European Union [EU], Korea, China).
- Provide support to the U.S. Council for Automotive Research (USCAR), and the USCAR/DOE Freedom Cooperative Automotive Research (FreedomCAR) Fuel Cell Technology Team.
- Review, comment, and refine testing protocols as necessary.
- Validate technical findings as directed by DOE.

Technical Barriers

This project can be directed to address any of technical barriers from the Fuel Cells section (3.4.4.2) of the Hydrogen, Fuel Cells and Infrastructure Technologies Program Multi-Year Research, Development and Demonstration Plan, however it principally addresses:

(A) Durability
(B) Cost
(C) Performance

Technical Targets

In this particular task, any of the technical targets in Table 3.4.4, Technical Targets: Integrated Stationary PEM Fuel Cell Power Systems (5-250kW) Operating on Reformate (page 3.4-16 of the Fuel Cells section of the Multi-Year Program Plan; http://www1.eere.energy.gov/hydrogenandfuelcells/mypp/pdfs/fuel_cells.pdf) may be addressed at any given time. Specifically, select tasks that apply to the technical targets in this project are listed below, while their status is listed in the 'Accomplishment' section.

- Provide test insight and advice to DOE solicitation winners.
- Testing and characterization of materials and participation in the further development and validation of a single cell test protocols with the U.S. Fuel Cell Council (USFCC).
- Offering technical assistance to USCAR and the FreedomCAR Fuel Cell Technology Team.
- Supply technical experts to the Tech Team as questions arise, focused single cell testing to support the development of targets and test protocols.
- Participating in working groups and review meetings.

Approach

Our approach has consistently focused on collaborative-type interactions to support the DOE Fuel Cell program. A large portion of this effort goes unpublished, for proprietary reasons. In this fiscal year, we continued testing support and have added several new analytical instruments to an already extensive infrastructure. These addition capabilities include 3-dimensional X-ray tomography, environmental scanning electron microscopy, inductively couple plasma mass spectrometry and mercury intrusion porosimetry. These instruments have been installed and have significantly strengthened our technical-assisting capabilities.

Accomplishments

- Honored several invited presentations.
- Hosted numerous visitors to LANL.
- Collaborated with multiple industrial, university, or laboratory partners.

- Provided testing insight and/or results to several DOE solicitation winners.
- Participated in the review and development of USFCC durability protocols.
- Prepared and tested three 50 cm^2 fuel cells using LANL's membrane electrode assembly (MEA) fabrication for a comparing JARI, EU and USFCC/LANL test protocols.
- Held hands-on fuel cell training short-courses

Highlights

Below are some highlights of the technical assistance task for Fiscal Year 2009.

As requested by DOE, LANL tested MEA performance for a funded DOE project at Case Western Reserve University (CWRU, see Figure 1). Performance polarization measurements were made under different conditions to evaluate the performance of MEAs for this project.

During the Nuvera Freeze workshop, scientists from LANL chaired breakout sessions. They openly discussed some of the challenges associated with the impact of freeze/thaw cycling on fuel cell performance. The cyclic voltammograms (CVs) in Figure 2 were taken after cycling the fuel cell from -10°C.

LANL evaluated samples from the National Institute of Standards and Technology (NIST). Figure 3 shows voltammetry examining the anode catalyst provided by NIST.

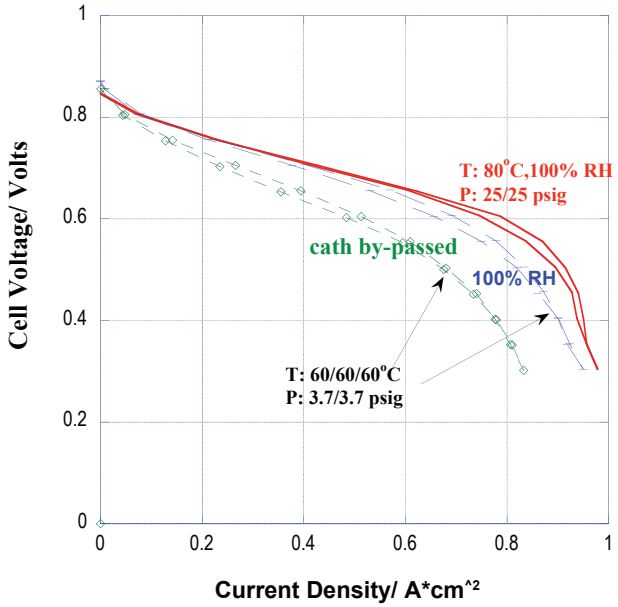

FIGURE 1. Polarization curves taken at different condition for a commercially available MEA. These results were disseminated to CWRU.

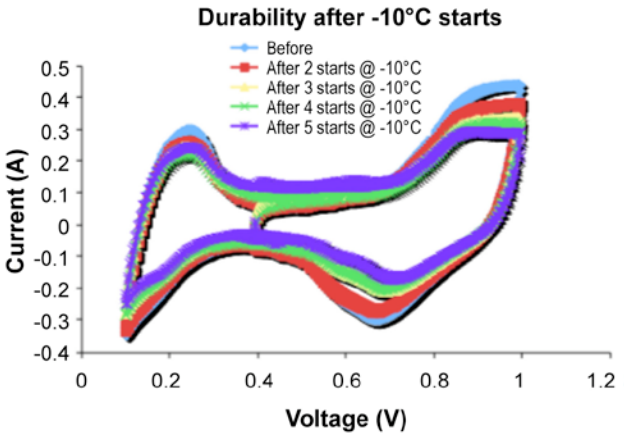

FIGURE 2. Los Alamos demonstrated loss in cathode catalyst surface area with repeated isothermal cold starts at sub-freezing temperatures. This loss was a function of MEA preparation method. These results were openly discussed at the Nuvera Freeze Workshop.

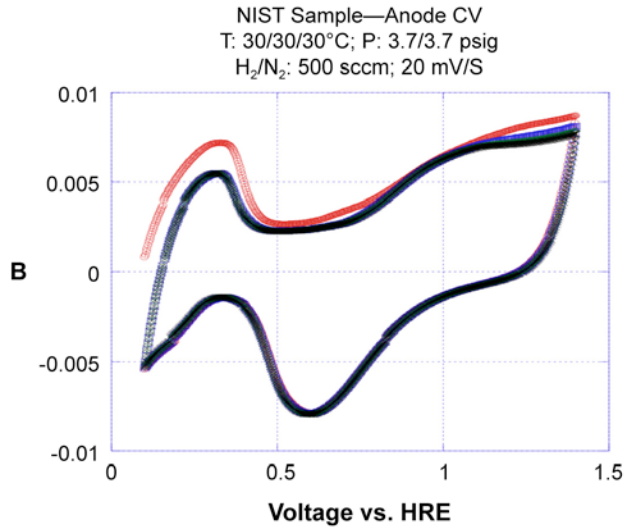

FIGURE 3. Cyclic voltammetry was run on a sample provide by NIST before running subsequent experiments such as hydrogen crossover measurements, break-in procedure, and polarization curves.

FY 2009 Publications/Presentations

1. Garzon, Fernando, Fuel and Air Impurity Effects in Fuel Cells, Gordon Conference, January 2009.

2. Mukundan, Rangachary, Performance and Durability of PEM Fuel Cell at Sub-Freezing Temperatures, Nuvera Freeze Workshop, February 2009.

3. Rockward, Tommy, FreedomCAR Tech Team Update, Detroit, MI, June 2009.