

V.A.6 Technical Assistance to Developers

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

Fiscal Year (FY) 2011 Objectives

- Support technically, as directed by DOE, fuel cell component and system developers.
- Assess fuel cell materials and components and give feedback to customers.
- Assist the DOE Durability Working Group with the development of various new material durability testing protocols.
- Provide support to the U.S. Council for Automotive Research (USCAR) and the USCAR/DOE Fuel Cell Technology Team.
- 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 Fuel Cell Technologies Program Multi-Year Research, Development and Demonstration Plan (MYRDDP), 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 of the MYRDDP 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 Accomplishments section.

- Provide continued testing insight and advice as directed by the DOE.
- Develop and validate new durability test protocols.
- Offering technical assistance to USCAR and the USCAR/DOE Fuel Cell Technical Team.
- Participating in working groups and review meetings.



Approach

Our approach has consistently focused on collaborative-type interactions as guided by DOE. A large portion of this effort goes unpublished, for proprietary reasons. We have actively participated in the DOE Durability Working Group. Our efforts have been focused on developing durability protocols. More specifically, four protocols are being discussed: rotating disc electrode (RDE)/rotating ring disc electrode (RRDE) measurements of performance and durability of non-precious group metal (PGM) oxygen reduction reaction (ORR) electrocatalysts, ORR electrocatalysts performance and durability measurements in half cell with liquid electrolyte under RDE/RRDE conditions, protocols for evaluating alternative electro-catalyst supports for proton exchange membrane fuel cells, and start/stop protocols for durability life testing. However in this FY, we have continued to provide testing support and actively participated in developing test protocols.

FY 2011 Accomplishments

- Hosted numerous visitors to Los Alamos National Laboratory (LANL).
- Collaborated with multiple industrial, university, or laboratory partners.
- Provided testing to several DOE solicitation winners.
- Participated in the review and development of several durability protocols.
- Hosted LANL-Japanese National Institute of Advanced Industrial Science and Technology-New Energy and Industrial Technology Development Organization Workshop and chaired several sessions (LANL scientists presented, also).

Highlights

Figures 1-5 show some highlights of the technical assistance task for the 2011 FY.

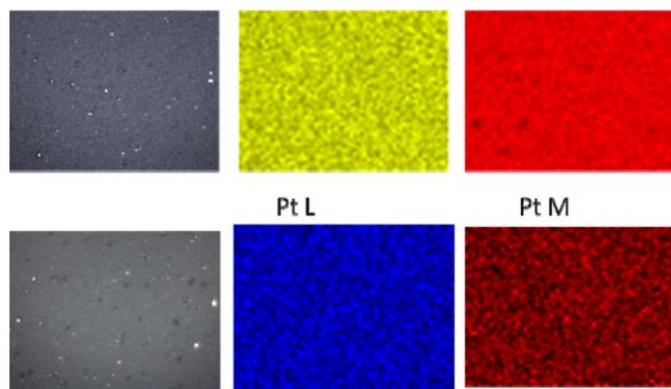


FIGURE 1. Scanning X-ray diffraction of commercial vendor membrane electrode assemblies (MEAs) using two Pt peaks at different energy provides complementary information: L lines show total Pt distribution (both sides of the MEA) and M lines show only one side of MEA.

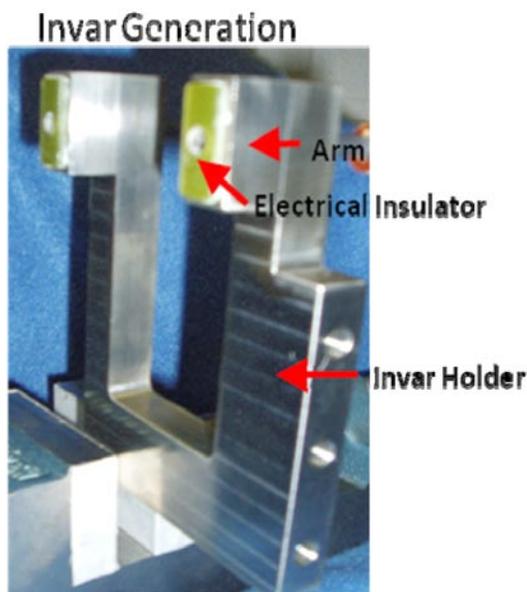
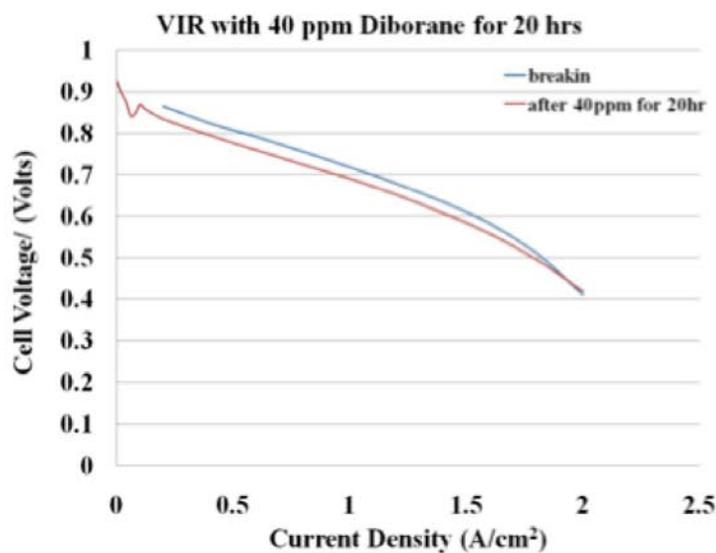


FIGURE 2. LANL designed, built, and provided a new and improved high-resolution fuel cell holder for neutron imaging at the National Institute of Standards and Technology (NIST). The new holder is notable for its uniquely low coefficient of thermal expansion. It has been provided to NIST to make available for all users.



VIR – voltage-current-resistance; HRE – hydrogen reference electrode

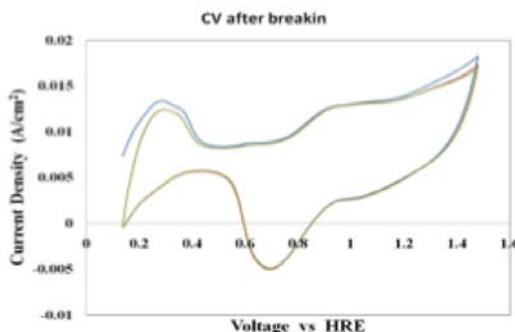
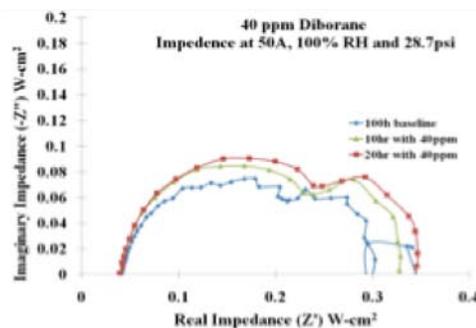
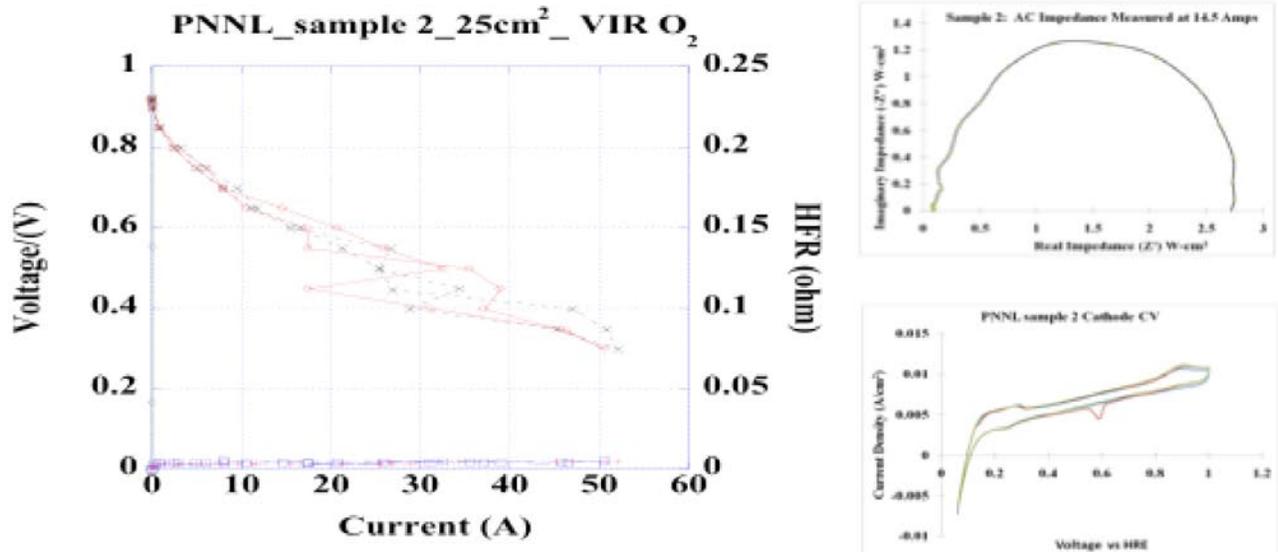
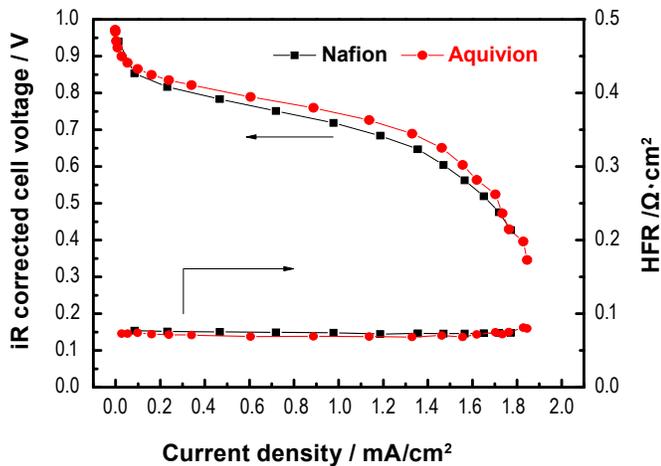


FIGURE 3. Examination of the impact of Diborane (being developed as a hydrogen storage material) as an impurity in the anode feedstream of a 50 cm² operating fuel cell. Provided voltage-current curves, alternating current impedance results, and cyclic voltammetry as a function of life testing. Shown is performance after exposure to 40 ppm Diborane for 20 hours.



HFR – high-frequency resistance

FIGURE 4. Results shown are from a 25 cm² fuel cell tested at 80°C, 100% relative humidity, with 3 stoichiometries at anode and cathode using air (not shown) and oxygen in support of DOE Catalyst Support Project. Alternating current impedance and cyclic voltammetry were also provided.



iR – internal resistance

FIGURE 5. Performance comparison of Nafion® and Aquivion®: Evaluation of short-side chain ionomer (Solvay Solexis).

FY 2011 Publications/Presentations

- LANL AIST NEDO Workshop, Honolulu Hawaii, August 2010
 - Fernando Garzon, Chaired: Durability (Impurities, etc.)
 - Christina Johnston, Chaired: Analysis, Characterization, Simulation, Structure Session
 - Rod Borup, Chaired: Mass Transportation Session
 - Piotr Zelenay, Chaired: Catalyst Low PGM Session
 - Yu Seung Kim, Chaired: Membrane Session
 - Rangachary Mukundan, Chaired: Durability Testing (accelerated stress tests, steady-state)
- Tommy Rockward, Technical Assistance to Developers Update, Fuel Cell Tech Team Update, Detroit MI, December 2010.
- Tommy Rockward, LANL Program Overview, JARI-DOE Meeting, Washington D.C., February 2011.