Hawai‘i Natural Energy Institute Research Highlights

Electrochemical Power Systems

Anion Exchange Membrane Fuel Cell

OBJECTIVE AND SIGNIFICANCE: The goals of this project are to 1) evaluate the performance of anion exchange membrane fuel cells (AEMFCs) with platinum group metal (PGM) content and PGM-free cathode catalysts under various operating conditions and 2) advance the understanding of effects of membrane electrode assemblies (MEAs) components on mass transport, water management, and durability.

BACKGROUND: Interest in AEMFCs technology (Figure 1) has been driven by the possible use of PGM-free catalysts instead of Pt at the anode and cathode enabled by the use of an alkaline electrolyte.

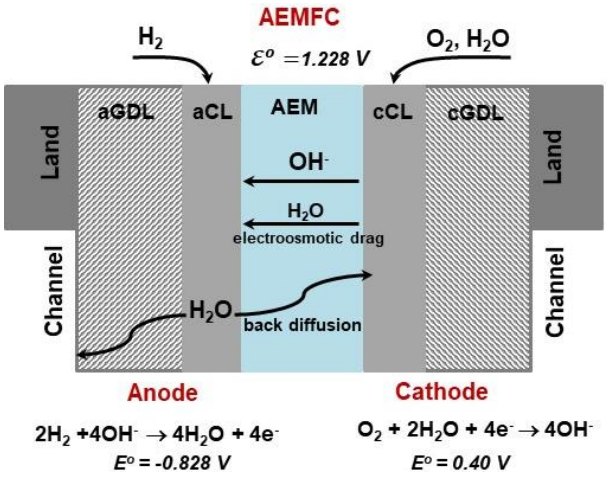

Figure 1. Schematic representation of AEMFC.

A logical step would be integration of Pt and PGM-free catalysts to the AEMFC MEA. However, well-established technologies of manufacturing of proton exchange membrane fuel cell (PEMFC) MEAs cannot be directly transferred into the field of AEMFCs. The main approach to improve AEMFC performance and durability is a design of catalyst layers with optimal porosity, hydroxide ion conductivity and thickness to insure development of three phase boundaries and sufficient reagents transport as well as adequate choice of gas diffusion layers (GDLs) for better water management.

PROJECT STATUS/RESULTS: Under this effort, HNEI has:

- Demonstrated that 25 wt.% ionomer loading is sufficient to ensure high performance of AEMFC;
- Established set of electrochemical diagnostics for AEMFCs including polarization curves, cyclic voltammetry and application of electrochemical impedance spectroscopy;
- Studied effects of inlet gas humidification and cathode feed gas configuration (O_2 vs air) on the performance of AEMFCs (Figure 2); and
- Continued to establish fuel cell testing capabilities at the UH Mānoa campus following the 2020 closure of HiSERF.

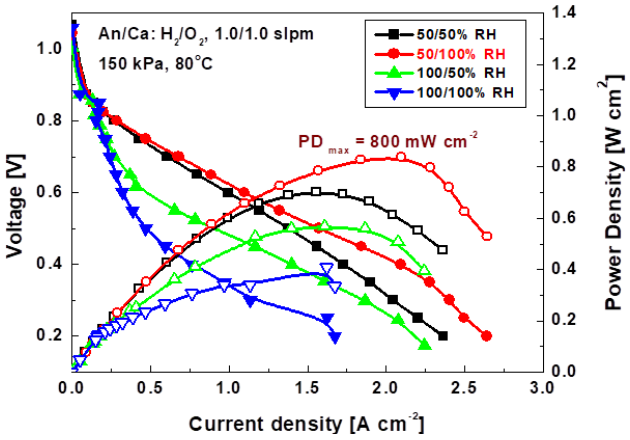

Figure 2. Polarization curves for different AEMFCs operated at various inlet gas humidification.

Future work will include a continuation of electrochemical studies of AEMFCs using available methods and techniques.

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