

Project ID: FC301

Membrane Working Group

PI: Bryan Pivovar^a & Yu Seung Kim^b

^aNational Renewable Energy Laboratory

^bLos Alamos National Laboratory

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This presentation does not contain any proprietary, confidential, or other wise restricted information

Overview

Timeline

- Project start date: 10/1/2018
- Project end date: TBD
- Percent complete: TBD

Budget

- Total project funding: \$200K
- DOE share: 100%
- Funding received in FY18/19: \$200K
- Total DOE Funds Spent*: \$30K

*As of 3/13/2018

Project Leads

- National Renewable Energy Laboratory
Bryan Pivovar (PI)
- Los Alamos National Laboratory
Yu Seung Kim (co-PI)

Barriers

- B. Cost
- C. Electrode performance
- A. Durability

Relevance

Objective

The Membrane Working Group serves to coordinate and accelerate the research community investigating polymer electrolyte membranes for energy conversion (and storage) devices.

Why do it?

- Bring membrane community together to educate, coordinate and accelerate advances and bring synergies across.
- Maximize the efficiency of project funding in membrane area.
- Provide common research information and gaps
 - Targets
 - Baselines
 - Protocols
- Growing importance of (low TRL) R&D needs in the area of polymer electrolytes
- Broader application than fuel cells, including electrolyzers, flow batteries, water purifications
- Prioritization of research needs/areas and input to DOE program office.

Approach

Background

Previous High Temperature Membrane Working Group consisted of government, industry, and university researchers interested in developing high temperature membranes for fuel cells. The working group focuses on hot and dry PEM operation <https://www.energy.gov/eere/fuelcells/high-temperature-membrane-working-group>

The new Membrane Working Group to focus on different polymeric materials used in fuel cells and other energy devices.

Coordinate fuel cell membrane research (present)

- Fuel cells: AEM, PEM, High Temp. PEM, Ionomeric Binder

Extended scope for interests (future)

- Membranes for different applications: Electrolyzers, Flow Batteries, Water desalination, Ammonia Synthesis and CO₂ Reduction.

Planning to socialize/refine premise/approach

- Webinar (March 5, 2019)
- DOE AMR (April 29 – May 1, 2019, Washington D.C.)
- AEM Workshop (May 30, 2019 at Dallas)
- Fall ECS Meeting? (Oct. 13 – 17 at Atlanta)/TBD

Approach

Membrane Working Group Coordination

Bryan Pivovar (NREL)

Yu Seung Kim (LANL)

Donna Ho (DOE, FCTO)

Participants

Project PIs and sub recipients of funded projects

- FCTO membrane-related projects (present)
- FCTO HydroGEN electrolysis projects (present)
- SBIRs/FCTO (present)
- ARPA-E IONIC – AEM (Topic 3), Flow Batteries (Topic 2) (present)
- ARPA E OPEN (present)
- FCTO EHC projects (future)
- BES projects (future)
- SBIRs/AMO (future)

Many funded projects focus on membrane synthesis so project PIs who are doing characterization/device performance/material interaction with other components will be brought to balance.

Feedback from MWG Webinar (3/5/19)

Participants: Over 30 participants from DOE, National Labs, Academia and Industry.

Topics discussed

- Mission and scope of MWG
- Justification of MWG
- Who to include, how to coordinate MWG
- AEM Workshop plan

Feedback from the participants

- The MWG should start focused and small, then be allowed to naturally expand more broadly later.
- An initial focus on anion exchange membranes seems like a logical approach.
- Unclear of value of making effort broad across different technology approaches.
- Coordinating or collecting information across efforts spanning different program offices seems sensible.

AEM Workshop on Thursday May 30

- Progress in AMFCs since 2016 has been impressive
- Many remaining issues, struggles within community related to protocols, testing, comparisons between groups, baseline materials
- Significant number of projects funded, remains a growing area of research focus
- Ideally focus on membranes/polymers and broader than just fuel cells as AEMs being developed for multiple applications



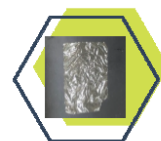
Sheraton Dallas Hotel
Dallas, Texas

Thursday
30 May 2019

in coordination with
2019 Spring Meeting
Electrochemical
Society

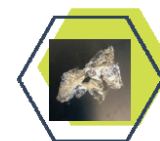
AEM WORKSHOP

ANION EXCHANGE MEMBRANE



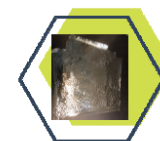
Challenges

identifying challenges of anion exchange membrane/ionomer (catalyst/ionomer interactions, water management, and carbonate formation)



Baseline Materials

baselining membrane and ionomer materials (selection and manufacturing of standard materials and round robin testing)



Test Protocols

testing protocols (application-specific metrics and targets)

NATIONAL RENEWABLE ENERGY LAB IN COORDINATION WITH DOE FCTO AND ARPA E

Contact: Bryan Pivovar | Bryan.Pivovar@nrel.gov

FOR BACKGROUND INFORMATION ON THE TOPIC, PLEASE REFER TO THE 2016 ALKALINE MEMBRANE FUEL CELL WORKSHOP AT [HTTPS://WWW.ENERGY.GOV/EERE/FUELCELLS/DOWNLOADS/2016-ALKALINE-MEMBRANE-FUEL-CELL-WORKSHOP](https://www.energy.gov/eere/fuelcells/downloads/2016-alkaline-membrane-fuel-cell-workshop)

AEM Session Speakers (ECS Wed, May 29)

Connection to

ECS/Shimshon symposium

- Specific talks in ECS session will help set stage for May 30 Workshop
- Topics covered will include AEM synthesis, durability, electrode fabrication, CO₂, water management, research advances and needs.
- Will allow us to focus on critical issues and fit into 1 day workshop

May 29 ECS Symposium I06

AEM presentations/presenters

Vito Di Noto

Chulsung Bae

John Varcoe

Bill Mustain

Mike Hickner

Irena Zenyuk

Brian Setzler

Chris Arges

Bryan Pivovar

Yushan Yan

Dimitrios Papageorgopoulos

Mike Yandrasits

Ben Achrai

Adam Weber

AEM Workshop Focus

Highest priority issues for AEMs

- Baseline materials
- Round robin/standardized testing protocols
- Metrics/Targets (build on ARPA-E)
- Challenges with carbonate, ion exchange (iodide form)

Highest priority issues for AEM based devices

- Catalyst ionomer interaction (fuel cell, electrolyzer)
- Water management (fuel cell, electrolyzer)
- CO₂ (fuel cell, electrolyzer)

Proposed Breakout Sessions (AM)

- Standardized Protocols – CO₂
- Standardized Protocols – Degradation, IEC, Mechanical
- Membrane Metrics/Targets

Proposed Breakout Sessions (PM)

- Electrode Issues
- Water/CO₂ Management
- Device Metrics/Targets

AMFC Workshop Draft Agenda

8:00	-	8:15	Opening Remarks, Dimitrios Papageorgopoulos DOE
8:15	-	8:30	Workshop Overview
8:30	-	9:00	Membrane Testing Challenges, Standardization
9:00	-	9:30	Membrane Targets/Metrics
9:30	-	9:45	Charge to Breakout Sessions
9:45	-	10:00	Break
10:00	-	noon	Breakout Session 1 (AEM Focus)
noon	-	1:00	Working Lunch – Out Brief from Breakout Session 1
1:00	-	1:30	Electrode Issues – Experimental
1:30	-	2:00	Cell Performance Issues – Modeling
2:00	-	3:45	Breakout Session 2 (AEM Device Focus)
3:45	-	4:00	Break
4:00	-	5:00	Joint Session -- Out Brief from Breakout Session 2
5:00			Concluding Remarks

Proposed Future Work

- **2019 AEM Workshop Report**
 - Current status of AEM development
 - Summary of technical challenges of AEM and ionomers
 - Test protocol update
 - AEM target (fuel cell) update
 - Collection of AEM targets for other applications
- **Complete the organization of MWG**
 - DOE Funding Agents
 - National Labs
 - Academia
 - Industries
- **Plans for 2020 MWG meetings**

Any proposed future work is subject to change based on funding levels.

Summary

- Objective:** The Membrane Working Group serves to coordinate and accelerate the research community investigating polymer electrolyte membranes for energy conversion (and storage) devices.
- Relevance:** Ion exchange membranes and ionomers are critical component of fuel cells and other energy device. MWG helps the membrane community to educate, coordinate and accelerate advances and bring synergies across. MWG also helps DOE to maximize efficiency of funding and provide information on membrane research priority.
- Approach:** MWG is coordinated by NREL, LANL and DOE FCTO. Participants include DOE funded project leader and sub-recipients. MWG starts with information exchange and organizing workshop and meetings for interactions between membrane researchers and related people.
- Accomplishments (FY 18)** MWG started with Webinar on March 5, 2019 discussing the mission, scope, justification and future meetings. AEM Workshop is planed after the ECS spring meeting at Dallas.
- Collaborations:** Collaborations with academia, industry and other national labs. MWG will interact with DOE programs with other funding agents including OE, AMO, ARPA-E, BES, etc.