

Electrolytic Hydrogen Production Workshop

DOE Fuel Cell Technologies Office hosted by:
NREL, Golden, Colorado Feb. 27th and 28th, 2014.

“Manufacturing and Scale Up Challenges:
Cell Components, Membranes, & Catalysts”.

by

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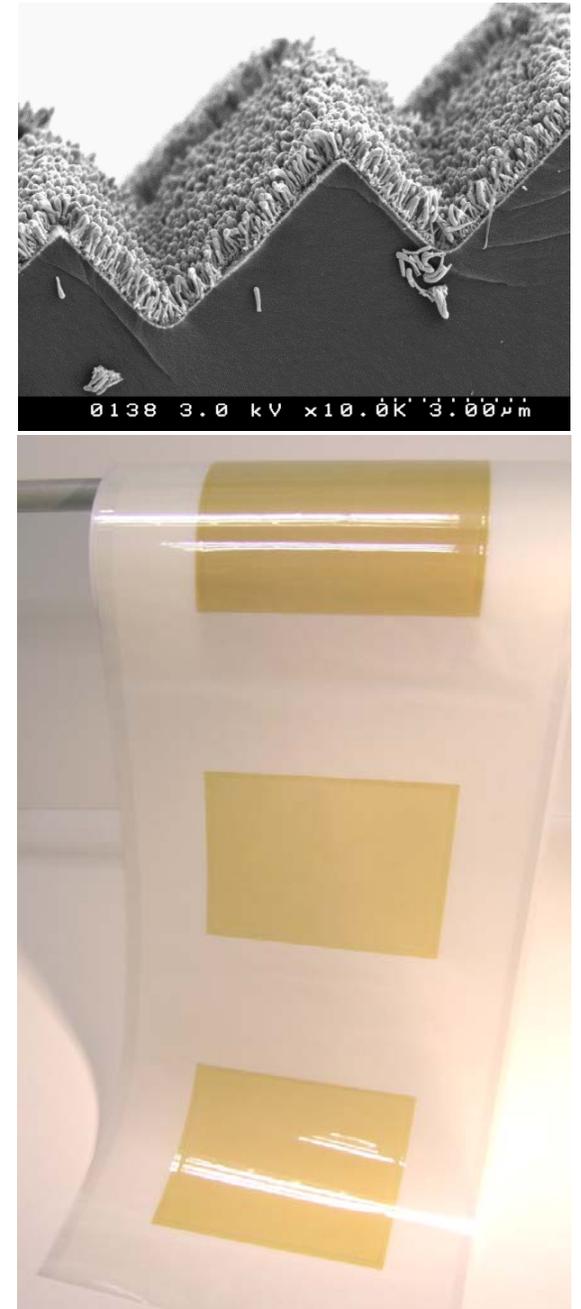
Goal: identify issues and opportunities for manufacturing and scale-up of electrolysis technologies: challenges, and suggestions for additional research, development and deployment activities which will help overcome those challenges.

Greatest Challenges and Opportunities:

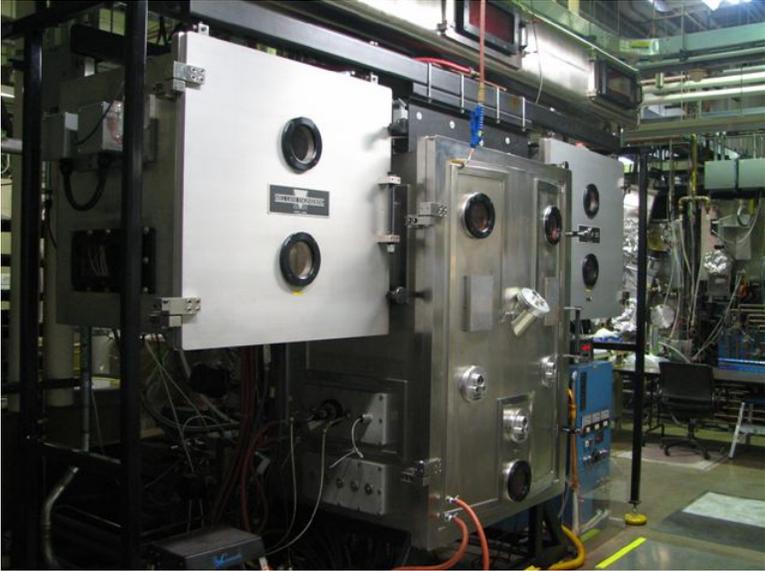
- PEM electrolyzer market at an early stage;
- Market development gaining momentum driven by demand for renewable energy;

Present Manufacturing Status at 3M

- 3M has been developing Fuel Cell components since 1990's,
- Sizeable investment had already been done in development of manufacturing capability for fuel cell components;
- Water electrolysis projects at 3M are leveraging that large investment in manufacturing of Fuel Cell components and adapting them to water electrolysis;
- 3M has it's own unique catalyst technology (NSTF) that could be very applicable to use as an electrolyzer catalyst;
- 3M has it's own PFSA based PEM with prospects of potential applicability to water electrolysis as well.



Manufacturing NSTF catalyst: Capabilities and Challenges



Capabilities:

- Roll-to-roll dry electrode coating;
- Vacuum sputtering to achieve low PGM loading;
- Supports and catalyst coated in one process;
- Alloy compositions, simple process to introduce new alloys;
- Process simplification over traditional dispersed coatings;
- Uniform PGM loading;

Challenges:

- Catalyst compositions not yet well proven in electrolysis mode
- Laboratory size catalyst runs made to date;



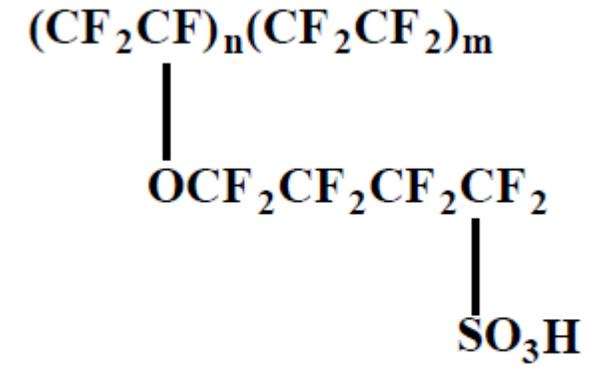
Manufacturing of electrolyzer specific PEM membrane: Capabilities and Challenges

Capabilities:

- Internal supply chain - monomer, ionomer, web casting;
- Large volumes of fuel cell membrane coated;
- Fully automated membrane coating line;
- Web-cleaning & air filtration, in-line inspection, etc.;

Challenge:

- More robustness needed for electrolyzer applications;



3M Polymer



Manufacturing of electrolyzer specific PEM CCMs and MEAs: Capabilities and Challenges

Capabilities:

- Roll-to-roll CCM/MEA high speed assembly process, aligned anode & cathode electrodes, laminated under heat & pressure, clean & defect-free, Automated in-line camera inspection;
- Sub-gasketed membrane (CCM thrifting), proprietary adhesive coating tech.;



Challenges:

- Process development for electrolyzer CCMs;
- incompatibility of existing GDLs with roll-to-roll processing (stiff porous Ti sinters);
- carbon-based GDLs – limited by electrochemistry
- GDL cost ;



Suggestions for additional research and development (R&D) activities

- Research innovative catalyst compositions (near-mid term);
- Development of membrane specific for use in electrolyzers (near term);
- Alternative GDLs (near term);
- Development of manufacturing and assembly processes (long term);
- Catalyst/CCM/MEA/Cell/System durability and long term stability (near-mid term);
- Mechanisms of failure (near term);
- Scale-up (long term);