

2018 Water Splitting Technologies Benchmarking & Protocols Workshop

The benchmarking team held a workshop for the advanced water splitting technologies within the EMN on October 24-25 at Arizona State University, in Tempe, AZ. It opened with a general plenary session to provide an overview of the program and the specific water splitting technologies (Low Temperature Electrolysis, High Temperature Electrolysis, Photoelectrochemical and Solar Thermal Chemical). Several breakout sessions were held for each technology area, to gather information for developing material protocols and identifying critical parameters. Report summaries were compiled and sent to the participants for each technology, as well as a cross-cutting summary. The action items are being reviewed by the benchmarking team and incorporated into a prioritized list of protocols to be drafted by the end of Budget Period 1. Experts are being brought in to partner in the development of these protocols. These protocols would then be tested and reported on at the next workshop in fall 2019.

Breakout Session Summaries

The LTE breakout sessions focused on developing standards and baseline test methods for each of the component materials that make up an LTE cell. PEM cells were relatively straightforward to define whereas AEM will require further work to identify and characterize standard materials. At the stack level, accelerated stress test protocols were discussed and will require further work to define and eventually validate.

The HTE breakout sessions aimed to identify standard HTE cell materials and suggest cell and stack testing protocols. Oxygen ion conducting electrolyte was selected for benchmarking cell, yet the opinions split on the cell configuration. Defining standardizing test and operating condition protocols would need to be prioritized. Accelerating tests by exposing cell to extreme conditions were deemed not relevant: they do not reflect “normal” cell aging and are often misleading. All participants agreed to participate in Round Robin “benchmarking cell” validation tests. Stack validation tests would require additional effort and are not suited for the academia sites.

The PEC breakout sessions focused on topics related to standard protocols at the component level and the device level. PEC stability testing protocols and in situ/operando measurements protocols for PEC interfaces and devices were discussed. Other topics including prototype formats, PEC electrolytes and protocol development in a half cell vs. a full cell.

The STCH breakout sessions focused on standards, metrics, and protocols primarily for the redox active metal oxide materials. There were 10 dedicated breakout sessions, with the 10th being a recap of what was discussed over the two days and the nine earlier breakouts. There was one breakout on important metrics, units, and system boundaries and one breakout on choosing standard materials. There were three breakouts on

thermodynamics, one being on “quick and dirty screening.” The “quick and dirty” thermodynamics breakout surprisingly stirred significant disagreements and led to the definition of two separate working groups, one for developing a protocol in the near-term and another to investigate an all new, yet to be identified, approach. There were two breakouts on kinetics and one on durability. One breakout was held on full systems performance and technoeconomics.

The Cross-Cutting breakout sessions brought experts together from all four water splitting technologies to discuss metrics and standards that are applicable across technologies. Sessions were also held to leverage experience with membranes and catalysts across multiple water splitting technologies.

Each breakout session included a quad chart that summarizes the outputs and action items from the session.

Breakout Sessions Summaries can be found on the [HydroGEN Data Hub](#).