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Authors

Mukundan, Rangachary

Arthurs, Claire

Kusoglu, Ahmet

et al.

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Membrane degradation in polymer electrolyte membrane fuel cells for heavy duty applications

Rangachary Mukundan^a, Claire Arthurs^a, Ahmet Kusoglu^a, Siddharth Komini Babu^b, Xiaojing Wang^b, Tanya Agarwal^b and Rodney Borup^b

^a Energy Technologies Area, Lawrence Berkeley National Laboratory, Berkeley, CA, USA

^b Material Synthesis and Integrated Devices Group, Los Alamos National Laboratory, Los Alamos, NM, USA

Polymer electrolyte membrane fuel cells (PEMFCs) are being considered for heavy duty applications, and the DOE has established various performance and durability targets to enable their adoption.¹ The key differences between light and heavy-duty application of fuel cells is their increased durability and operating efficiency requirements for heavy duty applications when compared to the lower cost requirement for light duty applications. While higher catalyst loadings can be utilized to increase the fuel cell performance and catalyst lifetime, membrane durability could be a significant outstanding challenge. Membranes are expected to last 25,000 hours to 30,000 hours for heavy duty applications and the Million Mile Fuel Cell Truck Consortium (M2FCT) is evaluating various membrane technologies for use in heavy duty drive cycles. Current state of the art membranes with both mechanical and chemical stabilization have already met light-duty durability requirement of 5000+ hours and have the potential to meet 25,000+ hour lifetimes. This talk will describe the various membrane related accelerated stress tests (ASTs) developed by the consortium and will present membrane durability results obtained from long-term (500 hours) fuel cell operation at elevated temperature (90 °C). Both the mechanical and chemical durability of membranes will be discussed with particular emphasis and fluoride emission rates (FERs) and lifetime predictions.

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