Investigation of an AEM Fuel Cell for direct Methanol Applications

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While there has been much interest in the proton exchange membrane (PEM) fuel cell, its widespread use has been restricted by cost, durability, and fuel versatility issues. This is primarily because Pt is the catalyst of choice for a PEM fuel cell on both the anode and the cathode.[1] Alkaline catalysis in fuel cells has been demonstrated with non-precious metal catalysts,[2] and with a variety of fuels beyond H_2 and methanol. Alkaline fuel cells (AFCs), based on aqueous solutions of KOH, have serious drawbacks associated with system complexity and carbonate formation. Anion exchange membrane (AEMs) fuel cells have a number of advantages over both PEM fuel cells and traditional AFCs; however, ionic conductivity in AEMs is significantly lower than PEMs and chemical stability of membrane cations in hydroxide has been poor.[3, 4]

The polyphenylene materials developed at Sandia National Laboratories typically have IECs of ca. 2.0 meq/g, good stability and can easily be tailored for use as the membrane separator or as the ionomer in the catalyst layer. We have built membrane electrode assemblies from this material and tested them in single cells.In this paper we will show our initial results using precious or non-precious metal catalysts on both the anode and cathode. Various fuels including methanol and hydrogen were investigated with or without KOH addition. Results will be presented that show optimization of the fuel cells.

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