Microcomposite Proton Exchange Membranes Based on Water Soluble Ionomers

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Foster-Miller is developing novel microcomposite fuel cell membranes for high temperature operation. Microcomposite membranes offer the potential to independently optimize the mechanical and the ion-conducting properties of the PEM, and to thus create a strong (high dimensional stability on immersion in boiling water) yet highly conductive membrane.

These PEMS are based on inert liquid crystal polymer (LCP) microporous membrane substrates, infused with a non-fluorinated proton-conducting ionomeric polymer. The microporous membrane provides the mechanical support required for durable functionality in high temperature PEMFCs, while the ionomeric polymer provides the required electrolyte properties. Our approach is to combine poly(benzaazole) rigid rod lyotropic LCP microporous membrane with sulfonated polyaromatic ion-conducting polymers (ICPs).

We have found that the properties of these microcomposite PEMs are enhanced by incorporating highly sulfonated, water soluble ICPs. Although conventional PEM materials and processes ordinarily preclude their being made from water soluble ionomers, the unique properties of the rigid rod lyotropic LCP substrates allow stable composites to be made with such ionomers. Figure 1 shows typical polarization curves for MEAs made from these PEMs.

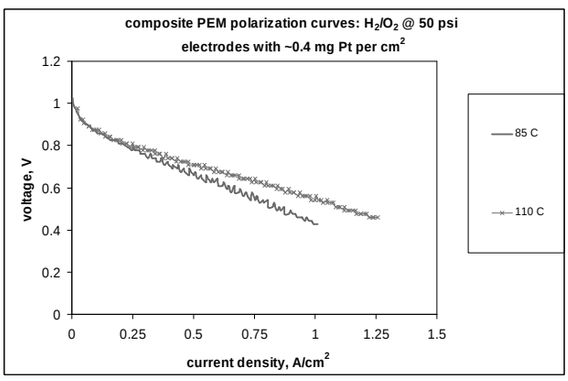

Figure 1. MEA polarization curves for LCP/water soluble ICP composite PEMs.

We will present preparation, characterization and performance data for PEMs and MEAs.