Liquid Crystal Polymer / Sulfonated Polphenylene Sulfone Microcomposite Membranes for High Temperature PEM Fuel Cells

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We are developing low cost microcomposite polymeric proton exchange membranes for high temperature (> 120 C) polymer electrolyte membrane fuel cells (PEMFCs). These are based on inert liquid crystal polymer (LCP) microporous membranes, 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(bis-benoxazole) (PBO) rigid rod lyotropic LCP microporous membrane with new, thermal-oxidatively stable sulfonated polyaromatic ion-conducting polymers (ICPs).

Initial results for PBO-based microcomposites containing sulfonated poly(phenylene sulfone) based ICPs, such as those shown for sulfonated poly(phenylene ether sulfone) shown in Figure 1, have been promising.

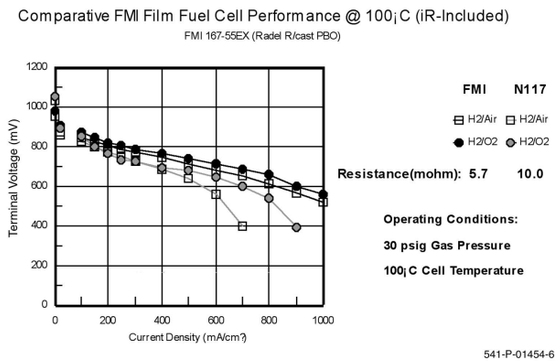

Figure 1. Fuel Cell performance of PBO / sulfonated polysulfone ICP microcomposite membrane versus Nafion 117 membrane at 100 C and 30 psig pressure.

However the use of novel unfluorinated PEMs presents major challenges in materials stabilization for long operational lifetimes and in membrane electrode assembly (MEA) fabrication.

We are proceeding to further develop both microporous LCP membranes and sulfonated arylene sulfone-based ICPs. We will present results for studies and characterization of chemical stabilization of sulfonated poly(phenylene ether sulfone) and sulfonated poly(phenylene sulfide sulfone), as well as results for microporous PBO membrane processing, and for MEA fabrication and testing.