Perspectives on PBI Membranes for Fuel Cells and Related Devices

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Polybenzimidazole (PBI) polymers are excellent candidates for PEM fuel cell membranes capable of operating up to 200˚C. Several years ago, we developed a sol-gel process to produce PBI membranes loaded with high levels of phosphoric acid. This process, termed the PPA process, uses polyphosphoric acid as the condensing agent for the polymerization and the membrane casting solvent. Membranes produced from this process showed the ability to maintain high levels of phosphoric acid (PA) and high proton conductivities while simultaneously exhibiting low levels of PA loss during operation.

We have been exploring the effects of chemical structure on the basic membrane properties, as well as issues of membrane stability and durability. We will describe some of our recent results on the correlations between polymer structure and properties which provide valuable insights for designing membranes with extended durability tailored to fuel cells and a growing number of devices related to energy applications.

Bio: Brian Benicewicz is the USC Educational Foundation Distinguished Professor in the Department of Chemistry and Biochemistry at the University of South Carolina. He received his BS from the Florida Institute of Technology and his MS and PhD degrees in polymer chemistry from the University of Connecticut. He worked at Celanese Research Company, Ethicon, Inc., and Los Alamos National Laboratory before joining Rensselaer Polytechnic Institute in 1997 as Director of the Center for Polymer Synthesis and Professor of Chemistry. Since 2008, he has been at the University of South Carolina where he holds the SmartState Chair in Polymer Nanocomposites. His research interests are focused on the development of high temperature polybenzimidazole membranes for fuel cells and electrochemical devices, and reversible addition-fragmentation chain transfer (RAFT) polymerization, particularly for the preparation of multifunctional nanoparticles and biomedical applications.