

72c Polymer-Filled Nanoporous Membranes

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Designing conductive or ionic polymers with unique nanostructures are of interest to a number of applications, including chemical separations, batteries, fuel cells, actuators and sensors. In this study, oriented nanostructured membranes were fabricated by conjoining a proton conductive polymer (sulfonated polystyrene) with nanoporous host membranes (track-etched polycarbonate and porous alumina). The host membranes contain straight cylindrical nanopores of uniform pore diameters oriented normal to the plane of the membrane. Synthesis of polymer-filled nanoporous membranes were explored with a number of different physical sorption techniques, where the pore-filling efficiency was examined in relation to the viscosity of the polymer solution, interfacial surface tension and radius of gyration. SEM images confirm successful pore filling with nanotubes of sulfonated polystyrene within the nanopores of the host membranes. Additionally, the conductive properties of the polymer-filled nanoporous membranes were measured using electrochemical impedance spectroscopy. Conductivity increased with decreasing pore size, increasing volume fraction, and increasing ion content. These results will be discussed in relation to the effect of the host nanostructure on the ionic polymer nanostructure.