Abstract Submitted
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NMR Studies of Water and Methanol Transport in Highly Sulfonated Membranes for Fuel Cells.[1] EUGENE MANANGA, JAY JAYAKODY, AMEESH KHALFAN, STEVE GREENBAUM, Hunter College of CUNY, THUY DONG, ZONGWU BAI, ROBERT MANTZ, Wright Patterson Air Force Base — Pulse gradient spin echo NMR was used to characterize the diffusion of water in highly sulfonated polyarylenethioethersulfone (SPTES) polymers. The proton NMR spectra as well as the diffusion rates were determined as a function of temperature. Comparison of electrical conductivity and diffusion activation energies indicate that H^+ and water transport are closely correlated. Several of the membranes were selected for further study for possible applications in direct methanol fuel cells. Both water and methanol diffusion coefficients were determined for membranes equilibrated in 2M aqueous methanol solutions. Water mobility is correlated with proton conductivity whereas methanol mobility is associated with undesirable crossover effects. The membranes based on SPTES polymers present a superior water/methanol diffusion ratio to that of the widely studied NAFION membrane. Finally, the effect of hydrostatic pressure up to 2.5 kbar on diffusion has been determined. Using pressure as the thermodynamic variable allows one to compute activation volumes for molecular transport. The results obtained for SPTES materials are similar to those of other sulfonated polymers, in that the activation volume is observed to decrease with increasing water content of the membrane.

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