

214d The Effect of Temperature and Pre-Treatment on Water and Methanol Sorption and Diffusion in a Short-Side-Chain Perfluorosulfonic Acid Ionomer Membrane for Pemfcs

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The sorption and diffusion properties of water and methanol vapors in a new, short-side-chain perfluorosulfonic acid ionomer (PFSI) membrane of low equivalent weight (860 gpol/mol SO₃H) have been investigated at different temperatures in the range of 35-120°C. Experiments show that pretreatment of the membranes under vacuum at low temperatures leaves in the polymer a residual amount of water, which decreases linearly with increasing evacuation temperature. The actual water content in the membrane, instead, is only slightly affected by temperature at fixed activity. For dry membranes, the sorption follows a dual mode behavior, with a downward curvature versus the activity axis. The water diffusivity increases with temperature and when plotted against water concentration shows a maximum. The higher value of the diffusion coefficient is reached at a water content which corresponds to a minimum of the solubility coefficient; such result suggests that different mechanisms take place during sorption of water molecules in PFSI, above and below a critical concentration value, which affect both the solubility and the diffusivity behavior. The molar uptake of water and methanol vapors is comparable, at fixed activity. The effect of the equivalent weight of membrane on the water uptake has been also studied.