278b Nafion®/Poly(Vinyl Alcohol) Blends: Effects of Crosslinking Conditions on Transport Properties

Nicholas W. DeLuca and Yossef A. Elabd

Optimizing the efficiency of the direct methanol fuel cell (DMFC) requires new polymer electrolyte membranes (PEMs) that exhibit high selectivity (i.e. high proton conductivity and low methanol crossover). In this study, crosslinked polymer blend membranes of Nafion® and poly(vinyl alcohol) (PVA) were developed and investigated. Preliminary data reveals that crosslinked PVA has a higher affinity for water compared to methanol, where Nafion's® preference is reversed. Blend membranes were crosslinked both chemically and thermally, where thermal crosslinking was performed at a variety of temperatures ranging from 120-250^{o}C.

As expected, proton conductivity decreases with increasing PVA content in the blend; however these trends differ based on the crosslinking technique. More specifically, at low PVA contents and high crosslinking temperatures, blend membranes were two times more selective with a similar proton conductivity compared to Nafion 117®, the most commonly used PEM in fuel cells. Blend membranes show a reverse trend with increasing crosslinking temperature, where proton conductivity remains constant, while methanol crossover decreases. This phenomena will discussed in relation to differential scanning calorimetry and infrared spectroscopy results.