278e Synthesis and Characterization of Thermosetting Copolymers as PEM's

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A major focus in the area of proton exchange membrane (PEM) development for fuel cells such as in the direct methanol fuel cell, is in the optimization of parameters such as membrane resistivity, nanostructure, thermal behavior, and methanol and water permeabilities. Our recent work concerning a novel material system of diglycidyl ether of bisphenol A (DGEBA) vinyl ester (VE) and 2-acrylamido 2-methyl propane sulfonic acid (AMPS) demonstrates a simple technique of forming network structures of hydrophobic and hydrophilic materials via thermally initiated free radical polymerization in the presence of dimethyl formamide (DMF) as a common solvent. In addition, nanoporosity is induced in these systems using supercritical fluid extraction. Characterization by water uptake measurements and AC impedance spectroscopy is carried out and observations of ionic conductivity as high as 0.0346 S cm-1 are reported. The effect of thermal treatment on the properties of the polymer membrane is also discussed with results indicating a correlation between induced porosity and AMPS content with water uptake and conductivity.