Nuannid Intaraprasit 2008: Preparation and Properties of Sulfonated Poly (ether ether ketone)/Analcime Composite Membrane for a Proton Exchange Membrane Fuel Cell (PEMFC). Master of Engineering (Chemical Engineering), Major Field: Chemical Engineering, Department of Chemical Engineering. Thesis Advisor: Associate Professor Paisan Kongkachuichay, Ph.D. 105 pages.

This research aims to synthesize Sulfonated Poly(ether ether ketone) (SPEEK)/ Analcime composite membranes for fuel cell application by adding Analcime into the matrix of SPEEK polymer. SPEEK with degree of sulfonation 0.64 and ion exchange capacity 1.88 mequiv.g^{-1} was prepared by sulfonation of Poly(ether ether ketone) (PEEK). Composite membranes were fabricated by blending SPEEK with 5, 10, 15, 25 and 35%wt. Analcime loadings. The obtained membranes were characterized by FTIR and SEM techniques, which confirmed the well distribution of Analcime particles in the SPEEK polymer. The results showed that Analcime particles were distributed uniformly in polymer matrix, added with amount up to 10%. Above 10% it started to agglomerate to form loose cluster. In all cases the presence of Analcime led to a decrease in the ion exchange capacity (IEC). Water uptake of the composite membrane decreased by increasing the amount of Analcime, meaning the embedded Analcime in the polymer matrix prohibited extreme swelling of the composite membranes. The proton conductivity of the membranes was measured by the Four Points Probe method showing that the composite membrane conducted proton higher than Nafion® 115 membrane. The highest proton conductivity value of the SPEEK/Analcime (10%) composite membrane was 0.1347 S/cm that was 4.6 times of Nafion membrane measured at room temperature. A distinct change in the morphology of the composite membranes could be observed with increased compactness of the matrix. Due to the presence of compact membrane matrix, these membranes will retard the hydrogen crossover. These composite membranes are easy to prepare and much less expensive than the commercial perfluorinated (Nafion) membranes. Hence, they can be used as a candidate electrolyte material for PEMFC in the future.

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