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EFFECTS OF SOLVENT ON PERFLUORINATED IONOMER SOLUTION AND FILM PROPERITES

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Perfluorosulfonic acid (PFSA) and Perfluorocarboxylic acid (PFCA) ionomers are polymers with unique properties which are used extensively as membrane in various industries such as cholr-alkali (CA) for chlorine production, electrodialysis, fuel cells etc. Although these polymers have excellent thermal and chemical stability, they must be replaced after sometimes operation. Due to their high cost and large consumption, efforts have been given to reclaim these materials. The main problem in recycling these membranes for chlor-alkali application is finding an economical dissolution and cast method for film preparation with required properties. Research has mainly been given to find a proper solvent which dissolves the used membrane. However, less consideration has been given to the solution and film properties which can affect the performance of the membrane.

The overall goal of this research is to explore the relationship between solvent composition and solution properties such as particle size, number of particles in the solution at constant concentration and cast film properties of the membrane such as water uptake, degree of crystallinity and ionic group aggregation with respect to performance in the CA cell.

Dynamic light scattering (DLS) and DSC studies were conducted to obtain solute particle size distribution in various solvents and film properties. Results show that the mean particle size and particle size distribution depends on the nature and the solubility parameter of the solvent. DSC test results show four peaks which can be attributed to the removal of ionic backbone water, hydrocarbon segment water, melting of crystalline sections and chemical degradation. Due to swelling phenomena increasing the water uptake increases the distances between ionic groups inside the clusters.