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Abstract of the Ph.D. Thesis

Our approach for the grafting process is to use BA in combination with AMS as the monomer system. BA is expected to enhance the polymerization of AMS on one hand, while some flexibility may be achieved into the grafted films due to the presence of butyl acrylate moieties within the grafted chain.

While the first chapter deals with the introduction, the second chapter of the thesis offers precise review on the membrane development for fuel cell. Chapter III deals with the radiation-induced graft copolymerization of AMS, BA monomers and their mixture was investigated on PEEK films. The graft polymerization was carried out using ethyl methyl ketone as the medium for the copolymerization and the maximum degree of grafting of 27% was achieved. It was observed that the grafting is significantly influenced by the reaction conditions, such as reaction time, preirrradiation dose, monomer concentration, monomer ratio and the reaction temperature. The degree of grafting increases as the monomer concentration increases up to 30%, beyond which a decrease in the grafting was observed. The degree of grafting showed a maximum at 40% BA content in the monomer mixture. The temperature dependence of the grafting process shows decreasing grafting with the increase in the reaction temperature. The presence of AMS and BA grafts in the film was confirmed by FTIR spectra. The relative change in the PAMS/PBA fraction with respect to the reaction temperature has been observed in this study.

Chapter IV deals with the characterization alpha methyl styrene (AMS)-butyl acrylate (BA) grafted PEEK films of varying copolymer compositions. The characterization of films was carried out with infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), thermogravimetry analysis (TGA), X-ray diffraction analysis, scanning electron microscopy (SEM) and atomic force microscopy (AFM). Chapter V deals with the sulfonation of AMS-BA grafted PEEK films. The characterization of resultant membranes was carried out with infrared spectroscopy (FTIR), differential scanning calorimetry (DSC), thermogravimetry analysis (TGA), X-ray diffraction analysis (XRD), contact angle (CA) and electron probe microanalysis (EPMA).

Chapter VI deals with the structure-property correlation in the graft copolymer membranes. The water uptake increases with the increase in the ionic content. The water/ionic ratio however shows significant increase at high degree of grafting. The conductivity and ionic mobility also show considerable increase in the membrane with high graft level. The results have been explained in terms of the water management in membrane matrix governed by the physico chemical changes in these membranes. Chapter VII deals with the summary of the work carried out under this investigation.