

Thermal, Dielectric and impedance spectroscopic studies of Sulphonated PEEK (SPEEK) and blends of SPEEK/Polyether imide

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PEEK is a well-known semi crystalline high performance thermoplastic polymer having high Temperature resistance, good chemical resistance, excellent dimensional stability and low moisture uptake. In the present investigation, attempts have been made to prepare proton-conducting membranes starting from PEEK (Victrex, U K), which can be used as polymer electrolyte membrane (PEM) in fuel cells. The sulphonated PEEK (SPEEK) membranes with different degrees of sulphonation were prepared and characterized using dielectric spectroscopy, impedance spectroscopy and DSC techniques. The relation between sulphonation time, degree of sulphonation (DS), ion exchange capacity (IEC) and proton conductivity has been systematically studied. DSC studies revealed that SPEEK membranes with DS up to 48% show no glass transition, but shows melting peaks in the range 190-200°C. SPEEK with DS 60-70% exhibits well-defined glass transition at around 150 °C but the melting endotherms are totally absent, indicating severity of thermal instability with an increase in sulphonation level of PEEK. SPEEK degrades beyond 220°C before reaching the melting region. The proton conductivity increases with an increase in DS. Hence it is necessary to make judicious compromise between DS, conductivity and operating temperature in typical PEM fuel cells. The highest conductivity obtained in this study is 5.1×10^{-6} S/cm, which is much less for possible usage in fuel cell as a solid electrolyte. Blends of PEEK and Polyether imide (PEI) are well known. Few blend compositions of SPEEK and PEI (Ultem) were also made and their proton conductivity was measured

Key words: *sulphonation, SPEEK, PEI, blends, fuel cells, proton conductivity, impedance spectroscopy, dielectric thermal analysis*

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