Structure-property relationships in radiation grafted poly(tetrafluoroethylene)-*graft*-polystyrene sulfonic acid membranes

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Abstract

Structure-property relationships in poly(tetrafluoroethylene)-*graft*-polystyrene sulfonic acid (PTFE-*g*-PSSA) membranes prepared by radiation-induced grafting of styrene onto poly(tetrafluoroethylene)(PTFE) films using simultaneous radiation-induced grafting followed by sulfonation reaction were established. The physico-chemical properties of the membranes such as ion exchange capacity, water uptake (swelling) and ionic conductivity were investigated in correlation with the degree of grafting (the amount sulfonated polystyrene grafted therein) and the structural changes taking place in the membrane matrix during the preparation step. The variation in the crystallinity of membranes was studied by differential scanning calorimetry (DSC). The membrane thermal stability was investigated using thermogravimetric analysis (TGA), ion exchange capacity and water uptake measurements. The membranes were found to undergo substantial structural changes in a form of ionic sites increase, hydrophicity enhancement, hydrophobicity reduction and crystallinity decrease with the increase in the degree of grafting. The all four factors were found to have a collective effect on the physico-chemical properties of the membranes but their relative contribution depends on the degree of grafting.

Keywords: Styrene; radiation-induced grafting; PTFE films; sulfonic acid membranes; physico-chemical properties; structure-property relationships.

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