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Sulfonated polystyrene pore-filled electrolytes membranes by electrons induced grafting of styrene into PVDF films: thermal stability and structural investigation

N. A. Zubir¹, A. F. Ismail¹, M. M. Nasef², K. Z. M. Dahlan³, H. Saidi²

¹Membrane Research Unit, Universiti Teknologi Malaysia, Faculty Of Chemical And Natural Resources Engineering, 81300 Skudai, Johor, Malaysia.

²Business Advanced Technology Center, Universiti Teknologi Malaysia, Jalan Semarak, 54100 Kuala Lumpur, Malaysia.

³Radiation Processing Technical Division, Malaysian Institute for Nuclear Technology Research (MINT), Bangi, 43000 Kajang, Malaysia

E-mail: aida_zubir@yahoo.com,/ NORAIDA@m-mmotor.com

This study investigates the thermal stability and structural investigation of sulfonated polystyrene pore-filled electrolyte PVDF membranes, obtained by radiation grafting of styrene into porous PVDF films and subsequent sulfonation, were carried out by thermal gravimetric analysis and differential scanning calorimetry, respectively. A three-step degradation pattern was observed from TGA thermograms of all the membranes, which attributes to the dehydration, desulfonation, and degradation of the PVDF backbone. The weight losses in the membranes were found to be reliant on the grafting yield, whilst the degradation temperatures were shown to be independent of the grafting yield. Meanwhile, the intrinsic crystallinity of the PVDF matrix was found out to show a decreasing trend with increasing in grafting yield. A further decrease in crystallinity is also observed in the sulfonation reaction. The residual crystallinity of the PVDF matrix approximately 5% was still remained in the membranes even it had been subjected to severe reaction conditions. The decreased in crystallinity of the resulting membranes can be explained by the combination of the dilution effect and the crystal disruption that occurred within the membrane's matrix.