CP-CT-1

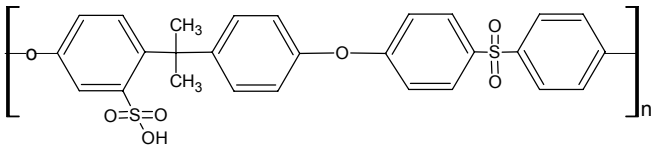
CHARACTERIZATION OF SULFONATED POLYSULFONE AND INFLUENCE OF SULFONATION DEGREE ON THE MEMBRANE WATER CAPTION

Kátia Costa, Luisa Magno de Carvalho, Ai Ren Tan e Ailton de Souza Gomes
IMA, Universidade Federal do Rio de Janeiro, PO Box 68525, 21945-970, Rio de Janeiro, Brazil;
E-mail:asgomes@ima.ufrj.br

Polymer electrolyte membrane fuel cell technology (PEMFC) has attracted increasing interest, particularly in automotive and stationary power applications[1]. The highlight of this technology is the ability of the membrane to conduct proton, besides promoting the separation between the components of anodic and cathodic cell compartments.

Actually, perfluorosulphonic acid polymer electrolytes, with the trade name Nafion and similar, are the most important proton conducting membranes, which has good performance and long-term stability[2]. However, the high cost of this materials and the decreasing in proton conduction due to water loss in membrane at elevated temperatures limit its use and constitute barriers to high fuel cell performance. Regarding those limitations, many groups of research have been studying alternative polymers, such as polysulfones[3], polyetherketones[4], polyimides[5], polybenzimidazoles[6], polyoxadiazoles[7], which present great advantages due lower cost, commercial availability and processability. To attain the conductive characteristics for an electrolytic membrane those polymeric materials are generally modified by introduction of sulphonic groups onto chain structure.

This paper describes some results of a study about sulfonated polysulfone (SPSU). The influence of the sulfonation degree on the water caption, glass transition temperature (Tg) and others physical properties of SPSU, is reported. The SPSU, structure I, was



(I) Sulfonated polysulfone (SPSU)

synthesized, and the respective sulfonation degree was determined by using different methods, such as FTIR, ^{1}H-NMR, and TGA.

Figure 1 shows the FTIR analyses of SPSU, where the band associated to symmetric stretch of O=S=O of sulfonate group (1024 cm^{-1}), used to following the sulfonation level in the polymer is assinalated. The padronization of FTIR curve was made by an absolute method.

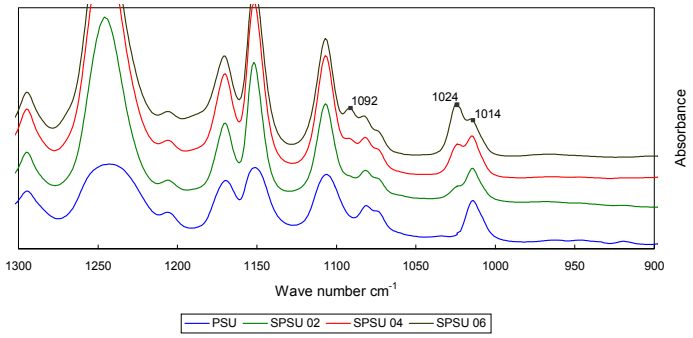


Figure 1- FTIR spectra of PSU and SPSU

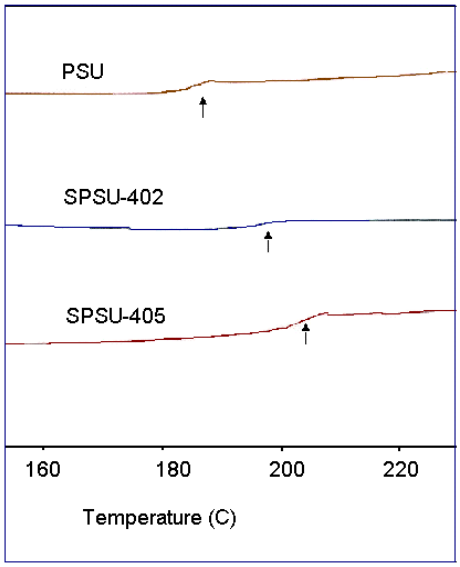


Figure 2: DSC of PSU AND SPSU

The introduction of sulfonated groups in the polysulfone increases intermolecular interaction by pendant ions. This effect hinders internal mobility which leads to increased glass transition temperature for sulfonated polymers, as we can see in the figure 2.

The Tg and water caption play important roles in the electrolytic membrane performance, due to its influence on the proton mobility.

Acknowledgements to CNPQ, CAPES and CTPETRO – FINEP – PETROBRAS for financial support.

References

[1] Kerres, J.A. "Development of ionomer membranes for fuel cells"; *Journal of Membrane Science 185*, 3-27, (2001).
[2] Formato, R.M.; Kovar, R.F.; Osenar, P.; Landau, N.; Rubin, L.S.; "Composite solid polymer electrolite membranes"; *US 6.248.469*, (2001).
[3] Lufrano, F.; Gatto, I.; Staiti, P.; Antonucci, V.; Passalacqua, E.; "Sulfonated polysulfone ionomer membranes for fuel cells"; *Solid State Ionics 145*, 47-51, (2001).
[4] Bailly, C.; Williams, D.J.; Karasz, F.E.; Macknight, W.J.; "The sodium salts of sulphonated poly(aryl-ether-ether-ketone) (PEEK): Preparation and caracterization"; *Polymer 28*, 1009-1016, (1987).
[5] S. Faure; "Synthesis and characterization of new polyimide sulfonated membranes for H_2/O_2 fuel" (1996)
[6] Glipa, X.; Haddad, M.; Jones, D.J.; Rozière, J.; "Synthesis and characterization of sulfonated polybenzimidazole: a highly conducting proton exchange polymer"; *Solid State Ionics 97*, 323-331, (1997).
[7] Zaidi, S.M.J.; Chen, S.F.; Mikhailenko S.D.; " Próton conducting membranes base don polyoxadiazoles" *Journal of new materials for electrochemical system* 3, 27-32 (2000)