

Nafion/CsHSO₄ Hybrids SAXS/ WAXS/ XAS Studies

José Fernando Queiruga Rey¹, Bruno Ribeiro Matos², Alessandro Longo³, Fabio Coral Fonseca², Daniel Hermida Merino³

¹Universidade Federal do ABC (CESC), ²Instituto de Pesquisas Energéticas e Nucleares, ³Netherlands Organisation for Scientific Research

e-mail: josefernando.rey@ufabc.edu.br

Nafion (Developed by DuPont) has been largely employed as solid electrolytes in Polymer Electrolyte Membranes (PEM) fuel cell applications. However, mild conditions (intermediates temperatures (~80 C), high relative humidity, and pure hydrogen fuel) are required to yield high fuel cell performances [1]. Nafion-based hybrid materials have been suggested as potential candidates to improve the performance of PEM fuel cells at higher temperatures and lower humidity conditions whilst maintaining the chemical stability and mechanical strength of the standard electrolyte. Hybrid materials are generally synthesized by the incorporation of hydrophilic inorganic nanoparticles in the polymer structure aiming at PEM operating above 100 °C [2]. The precursor solution impregnates the Nafion membrane and a subsequent thermal treatment induces the nucleation and growth of the nanoparticles inside the membrane. In the last decade, great efforts have been focused on the investigation of the property-structure relationship to improve the technological applications [3]. The aim of our study is to study the mechanism of growth of the nanoparticles embedded at the Nafion membranes by SAXS (Small Angle X Ray Scattering)/ WAXS (Wide Angle X Ray Scattering) as well as to understand the chemical environment of the nanoparticles within the polymeric internal structure by XAS (X Ray Absorption Spectroscopy) in the Caesium (Cs) K-edge. The main results shown a strong relationship between the hybrid membranes morphology and the concentration/synthetic route of the inorganic species.

Acknowledgements

This work is partially supported by FAPESP (2016/19791-6, 2014/09087-4-, 2014/50279-4)

References

- [1] Mauritz, K, A; Moore, R. B. Chem. Rev. 104 (2004) 4535.
- [2] E. Gerasimova, E. Safrona, A. Ukshe, Y. Dobrovolsky, A. Yaroslavtsev, Chemical Engineering Journal, 305 (2016)121.
- [3] K-D Kreuer, G. Portale, Advanced Functional Materials, 23 (2013) 5390