

Conformation of grafted polymer chains in nanoporous membrane

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Nanoporous anodized aluminum oxide membrane (AAO) is one of the most popular nanomaterial because of its simple, cheap and well controlled fabrication process. For example, several studies showed that grafting or adsorbing polymer chains within the pores can influence significantly the flow of simple liquids, translocation rate of polymer chains or even ionic conductivity[1]. On the fundamental point of view, several studies managed to characterize the brush extension on flat and convex surfaces[2]–[4]. These studies highlighted a very good agreement between the experimental studies and the scaling law model developed by Alexander, De Gennes, Daoud and Cotton. However, regarding concave polymer brush, there is still a theoretical debate on the validity of the Daoud-Cotton model for such systems [5]. Here, we used small angle neutron scattering in order to probe the conformation of end-grafted polystyrene chains within AAO nanopores with diameter ranging from 20 to 60 nm. We show that the molecular weight of grafted chains and their grafting density influence the form factor of the pores.

As a complementary characterization, we determined the hydrodynamic radius of the grafted nanopores by measuring the flow rate at constant pressure drop. The comparison of both SANS and flow permeability experiment allows to couple molecular insight and transport properties of grafted nanoporous membrane.

1. Md Jani, et al. . Prog. Mater. Sci. 58, 636–704 (2013).
2. Lal, J., et al., J. Phys. II 7, 19 (1997).
3. Auroy, P. et al., . J. Phys. II 3, 227–243 (1993).
4. Marzolin, C. et al. . Macromolecules 34, 8694–8700 (2001).
5. Manghi, M., et al., Eur. Phys. J. E 5, 519–530 (2001).

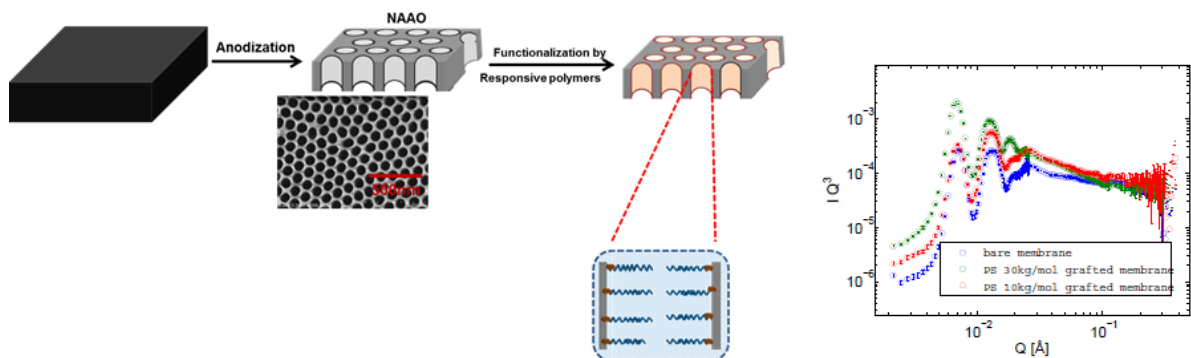


Figure 1 : (left) : *Synthesis scheme of polymer grafted aluminum oxide nanoporous membrane*
(right) : *SANS spectra of bare membrane and grafted PS-NH₂ which molecular weights are 10kg/mol and 30 kg/mol immersed in a mixture of THF-h and THF-d (31.1 %/ 69.9 %*