

CEA - Saclay 91191 Gif-sur-yvette Cedex
Service de Physique de l'Etat Condensé
SÉMINAIRE

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Orme des Merisiers SPEC Salle Itzykson, Bât.774

Characterization and modification of track-etched nanopores

Birgitta Schiedt

Gesellschaft für Schwerionenforschung (GSI), Planckstr. 1, D-64291 Darmstadt, Germany

Synthetic nanopores have a large potential in biotechnology, where they can be applied e.g. as filters, sensors for biomolecules or as single-molecule detectors and analyzers. For all these applications it is important to understand the pores ionic transport characteristics and to be able to influence them at will, depending on the desired application. In this context it is highly desirable to be able to control the pores surface properties, i.e. functionalize them, to match specific requirements concerning hydrophobicity, selectivity or interactions with various biomolecules. The track-etching technique, which is based on irradiation with swift heavy ions and subsequent chemical etching, is a well established method to create nanopores of various geometries in polymer foils [1]. Single, conical pores in polyethylene terephthalate, polyimide and polycarbonate show asymmetric current-voltage characteristics (a phenomenon called rectification) as well as permselectivity [1,2,3].

These properties, which are basically resulting from electrostatic interactions, have been addressed by a number of theoretical approaches [3,4,5,6], including a model based on the Poisson and Nernst-Planck (PNP) equations [4,7,8], which provides good agreement between experiments and calculations.

The polymeric substrate of the pores opens the possibility to directly chemically modify the functional groups present at the inner pore walls by a variety of methods. For example amines can be covalently coupled to the carboxyl groups present on the etched surfaces of most polymeric pores, resulting in control over the surface charge of the pore [9,10]. By this method, any molecule containing free amino groups can potentially be attached to the surfaces of these pores, allowing the creation of desired interactions between the pore walls and molecules present in the electrolyte solution.

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Contact : fabien.portier@cea.fr - Tel : +33 1 69 08 72 16/74 75
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