

Preparation of synthetic nanopores with transport properties analogous to biological channels

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Conically shaped pores have been prepared in polyethylene terephthalate (PET) and polyimide foils by applying the track-etching technique. For this purpose, a thin polymer foil was penetrated by a single heavy ion (e.g. Au, Bi, U) of total kinetic energy of several hundred MeV to some GeV, followed by preferential chemical etching of the ion track. Asymmetric etching conditions allowed the preparation of charged pores of conical shape, similar to biological voltage-sensitive channels. The nanopores in PET and polyimide behave as ion current rectifiers where the preferential direction of the cation flow is from the narrow entrance towards the wide aperture of the pore. The PET pore shows voltage-dependent ion current fluctuations with opening and closing kinetics similar to voltage-gated biological ion channels. In contrast to PET, the polyimide nanopore exhibits a stable ion current signal. We discuss the possibility of using the synthetic nanopores as model for voltage-gated biochannels.