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Modification of polymeric track membranes by exposure to various plasma configurations

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Intensive efforts have been devoted lately to the development of membrane processes including gas separation, water desalination, pervaporation, purification of biologically active compounds, etc. Nevertheless, the intrinsic properties of membranes, in particular those of polymeric materials, may be greatly improved by subsequent processing aiming the modification of composition and structure of the surface layer. In this work we present an overview of the results obtained upon processing of polymeric nuclear track membranes (TM) in various plasma configurations. Polymeric foils of polyethylene terephtalate (PET) and polypropylene (PP) have been irradiated by accelerated heavy ions (1-3 MeV/nucleon) and chemically treated in order to obtain TM with cylindrical nanochannels of 60 – 400 nm diameter. Various types of plasmas were considered for controlling the TM transport and/or filtration properties. The results showed that membranes exposure to non-depositing plasmas (like H2, He, Ar, O2, N2, air, or halogens) conduct to surface etching, formation of conical-shaped pores and addition of functional groups on the membrane surface and inside its pores. On the other hand, exposure to depositing plasmas by means of PECVD or plasma polymerization processes with various precursors (C2H2, C2H2F4), monomers (C4H4S, C4H5N) or organosilicon (HMDSO, HMDSN) vapors, or by physical vapor deposition processes starting from polymeric targets (PTFE, PP, UHDPE) in RF magnetron sputtering or electron beam deposition results in a wide variety of bi-layered membranes with transport properties controlled by the specificity of the deposited polymers in terms of chemical composition, morphology, and/or behavior in solution (e.g. swelling or wettability).
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