Nanocomposites and nanomaterials

High temperature track nanoporous membranes from modified polycyanurates: design, characterization, gas permeability and selectivity

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In this work the polycyanurate network (PCN) based on bisphenols A and E was chemically modified with 10 wt.% of polytetramethylene glycol (PTMG, MM=1,000 g/mol) or linear polyurethane (LPU, MM=40,000 g/mol) in order to reduce brittleness of high crosslink density PCN. Then the thin PCN-based films were irradiated by accelerated alpha particles followed by sensitization and chemical etching of the tracks formed. Using FTIR, DSC and TGA techniques it was established that nanoporous films retain their chemical structure and thermal properties. Using SEM, DSC-based thermoporometry and BET method the porosity parameters of the nanoporous PCN-based films were determined. The average pore size was 25-160 nm with the majority of the pores of an average diameter of about 50 nm. The permeability of the track nanoporous membranes obtained for He, O_2, CO_2, N_2 and CH_4 was studied and the ideal selectivity values have been calculated. The higher permeability coefficients have been fixed for He and CH_4. It is observed that sensitization as well as increase in etching time lead to increasing permeability coefficient for PCN/PTMG and PCN/LPU track membranes and allow keeping interesting gas selectivity parameters. This work was partly financially supported by CNRS (France)-NASU (Ukraine) PICS project # 5700 (2011-2013).