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Porous polymeric membranes with thermal and solvent resistance

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Abstract

Polymeric membranes are highly advantageous over their ceramic counterparts in terms of the simplicity of the manufacturing process, cost and scalability. Their main disadvantages are low stability at temperatures above 200 ˚C, and in organic solvents. We report for the first time porous polymeric membranes manufactured from poly(oxindolebiphenylylene) (POXI), a polymer with thermal stability as high as 500 ˚C in oxidative conditions. The membranes were prepared by solution casting and phase inversion by immersion in water. The asymmetric porous morphology was characterized by scanning electronic microscopy. The pristine membranes are stable in alcohols, acetone, acetonitrile and hexane, as well as in aqueous solutions with pH between 0 and 14. The membrane stability was extended for application in other organic solvents by crosslinking, using various dibromides, and the efficiency of the different crosslinkers was evaluated by thermogravimetric analysis (TGA) and X-ray photoelectron spectroscopy (XPS). POXI crosslinked membranes are stable up to 329 ˚C in oxidative conditions and showed organic solvent resistance in polar aprotic solvents with 99% rejection of Red Direct 80 in DMF at 70 ˚C. With this development, the application of polymeric membranes could be extended to high temperature and harsh environments, fields currently dominated by ceramic membranes.

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