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Synthesis of TiO_2 Nanostructure Membrane and Influence of ZrO_2 Addition on Microstructure, Thermal Stability and Membrane Properties

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Abstract

A technique for the synthesis of crystalline TiO_2 nanostructured membranes by the sol–gel method is determined. Macroporous α-alumina support was used as substrate and intermediate layer was gained by coating and calcination of the colloidal titania sol on the mechanical support. The effect of several processing variables on particle size and sol stability of titania was studied. The influence of 20mol% zirconia doping on microstructure, liquid permeability, thermal and mechanical stability of composite titania/zirconia membranes was investigated. The thermal and mechanical stability, phase transformation, surface morphology, pore size distribution and permeation of the defect-free titania-zirconia membrane were investigated by using X-ray diffraction(XRD), Atomic Force Microscopy (AFM), gas adsorption analyzer (BET), TG-DTA Analysis, scanning Electron Microscope(SEM), FTIR Analysis and water permeation apparatus, respectively. It was shown that zirconia retards the phase transformation of anatase to rutile until at least 700 ^oC. The pore size decreases to 1.2 nm by addition of up to 20 mol% zirconia, while nitrogen sorption experiments shows that the porosity, BET surface area and pore connectivity increases.

Keywords*:* Titania-zirconia membrane, Thermal stability, Dip-coating, Water permeation.

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