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Experimental investigation of the transport mechanism of several gases during the CVD post-treatment of nanoporous membranes

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This work stresses the importance of combining gas transport theories with experimental gas permeability results on the effort to elucidate the pore structure evolution of nanofiltration membranes during their modification through the chemical vapour deposition technique. To this end, silica membranes of 1 nm nominal pore size were post-treated by applying a sequential cyclic CVD method at 573 K and the Tetraethyl-orthosilicate/Ozone reaction system. Alteration of the gas transport characteristics was investigated by conducting single gas permeance measurements of Helium and Nitrogen at selected temperatures following the completion of several CVD cycles. The experimental results were interpreted on the basis of gas transport theories combined with a model for the evolution of pore size distribution of the membrane's separation layer during silica deposition. By monitoring permeation properties of the treated membranes with the progress of deposition using Helium and Nitrogen as probe gases, optimized treatment conditions can be established in order to fabricate selective and highly permeable – with respect to Hydrogen gas – ceramic membranes. Furthermore, the dependence of the permeation properties on the pore size of the studied membranes before and after their CVD treatment was investigated by performing single-gas permeance measurements of several probe gases within a wide temperature range.

Biography

Anastasios Labropoulos received his Chemistry Diploma from the University of Thessaloniki (Greece) in 2002. He completed his MSc and PhD from the Department of Chemistry, University of Athens (Greece) in 2005 and 2010 respectively. He has joined the Institute of Physical Chemistry in NCSR "Demokritos". His overall research activities have been focused on the fields of (i) fabrication, characterization and performance evaluation of membranes for gas separations, (ii) investigation of gas transport through porous membranes, (iii) gas sorption and storage in nanostructured materials and (iv) supported ionic liquid membranes. He is co-author in 12 publications in peer reviewed journals.

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