Recent Advances in Techniques for Porosity Characterization of Membranes

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Abstract

In many applications membranes act as barriers to particles or organisms. The barrier characteristics of membranes are determined by the pore diameters and distributions inmembranes. Gas, vapor or water vapor transmission rates through membranes are also important for many other applications. Appropriate techniques have been developed to measure pore structure characteristics of membranes, which can be thin and fragile, and can be metallic, polymeric, or ceramic. In this paper four novel techniques for measurement of various pore structure characteristics of membranes and the applications of these techniques are presented.

In advanced flow porometry, pores of the samples are filled with a wetting liquid and a nonreacting gas is used to displace the liquid from pores and permit gas flow. Differential pressures and gas flow rates through wet and dry samples are measured. The largest pore diameter, the mean pore diameter, pore distribution, and gas permeability are computed. It is also possible to measure liquid permeability. Pores in membranes are detectable over a wide range. In the water intrusion (aquapore) technique, intrusion volume of water is measured as a function of differential pressure. This technique is capable of measuring pore diameter, pore distribution and pore volume of hydrophobic pores in a membrane. Very small gas or vapor transmission rates through membranes are measurable by diffusion permeametry. The water vapor transmission rates through membranes due to humidity gradients are measurable by the water vapor transmission analyzer.

Data are presented to illustrate applications of these techniques for measurement of many unique characteristics of membranes. These results are critically examine.