PORE SIZE MEASUREMENTS OF FINE FILTRATION MEMBRANES BY CAPILLARY FLOW, THERMOPOROMETRY, AND EVAPOPOROMETRY

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Pore size plays an important role in the performance of liquid filtration membranes. In this study, the pore size distribution of highly retentive membranes were measured by five different test methods: gas-liquid porometer, liquid-liquid porometer, NMR, DSC and evaporation of IPA. The first two are based on capillary flow, with gas-liquid by far the most used pore size measurement method at Gore. NMR and DSC are based on thermoporometry and capable of measuring pore size below 10 nm by measuring the depressed melting temperature of liquid imbibed into the porous membranes. Evaporometer calculates the pore size distribution based on the Kelvin's equation and relates the pore size to the rate of evaporation of a volatile fluid. A selection of membranes were investigated. DSC and NMR were found to be highly sensitive to small pores (~10 nm). An evapoporometry setup was established and demonstrated to measure down to 5 nm. However, the open layer has a large influence on the measurement. Finally. it was demonstrated that liquid-liquid capillary flow porometer can measure pores down to 40 nm with significantly lower operating pressure than gas-liquid method, thus minimizing the distortion of membranes during measurement.