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Pressure driven water flow through hydrophilic alumina nanomembranes ALI BESKOK, ANIL KOKLU, SEVINC SENGOR, Southern Methodist University — We present an experimental study that focuses on pressure-driven flow of distilled water through alumina membranes with 5, 10 and 20 nm pore radii. The nanopore geometry, pore size and porosity are characterized using scanning electron microscopy images taken pre and post-flow experiments. Comparisons of these images have shown reduction in the pore size, which is attributed to precipitation of hydroxyl groups on alumina surfaces. Measured flowrates compared with the Hagen–Poiseuille flow relations consistently predict 2.2 nm reductions in the pore size for three different membranes. This behavior can be explained by the formation of a thick stick layer of water molecules over hydroxylated alumina surfaces, evidenced by water droplet contact angle measurements that exhibit increased hydrophilicity of alumina surfaces. Other possible effects of the mismatch between theory and experiments such as unaccounted pressure losses in the system or the streaming potential effects were also considered, but shown to be negligible for current experimental conditions.

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