Abstract Submitted
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Fabrication and characterization of vertically aligned carbon-nanotube membranes[1] RICHARD CASTELLANO, CEVAT AKIN, MATT PURRI, JERRY SHAN, Rutgers University, SANGIL KIM, FRANCESCO FORNASIERO, Lawrence Livermore National Labs — Membranes having vertically-aligned carbon-nanotube (VACNT) pores offer promise as highly efficient and permeable membranes for use as breathable thin films, or in filtration and separation applications, among others. However, current membrane-fabrication techniques utilizing chemical-vapor-deposition-grown VACNT arrays are costly and difficult to scale up. We have developed a solution-based, electric-field-assisted approach as a cost-effective and scalable method to produce large-area VACNT membranes. Nanotubes are dispersed in a liquid polymer, and aligned and electrodeposited with the aid of an electric field prior to crosslinking the polymer to create VACNT membranes. We experimentally examine the electrodeposition process, focusing on parameters including the electric field, composition of the solution, and CNT functionalization that can affect the nanotube number density in the resulting membrane. We characterize the CNT pore size and number density and investigate the transport properties of the membrane. Size-exclusion tests are used to check for defects and infer the pore size of the VACNT membranes. Dry-gas membrane permeability is measured with a pressurized nitrogen-flow system, while moisture-vapor-transfer rate is measured with the ASTM-E96 upright-cup test. We discuss the measured transport properties of the solution-based, electric-field-fabricated VACNT membranes in reference to their application as breathable thin films.

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