

408d Carbon Nanotube Mixed Matrix Membranes for Gas Separation

Sangil Kim, Eva Marand, and Todd Pechar

Recent atomistic simulations by Sholl and coworkers have predicted that carbon nanotubes, if used as membranes, have the flux/selectivity properties that far exceed those of any other known inorganic or organic material. To verify this prediction, we have fabricated nano-composite membranes consisting of both open-ended and close-ended single-walled carbon nanotubes, CNTs, embedded in a poly(imide siloxane) copolymer and evaluated their transport properties. Permeation and sorption measurements of He, N₂, O₂, and CH₄ were carried out as a function of CNT content and orientation. Orientation of the CNTs was achieved in a magnetic field. Permeability measurements of He showed drops in permeability with the addition on close-ended CNTs. This large drop in permeability of He suggests that the close-ended CNTs act as an impermeable filler and more importantly that the copolymer adhered well to the CNTs, i.e. that the prepared CNT MMMs were defect free. However, the permeability of O₂, N₂ and CH₄ increased in proportion to the amount of open-ended CNTs in the polymer matrix and with degree of orientation. This suggests that gas diffusion does indeed take place through the carbon nanotubes and that CNTs offer an attractive additive for universally enhancing the gas permeability.