

Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Chemically Designed Molecular Interfaces in Cross-Linked Poly(ethylene glycol)/Silica Nanocomposites Reveal Strong Size-Dependent Trends in Gas Permeability NORMAN SU, Univ of California - Berkeley, JEFFREY URBAN, Lawrence Berkeley National Lab — Polymer nanocomposite membranes can exhibit gas separation performance that surpasses conventional polymeric membranes. While promising, the optimization of nanocomposite membranes requires a fundamental understanding of the transport mechanism and interfacial effects between the inorganic and polymer phase that is currently limited to empirical relationships. Synthesized nanocomposites often consist of poorly distributed and polydisperse inorganic nanomaterials. It is known that polymer dynamics can change drastically upon introduction of an inorganic phase, which can dramatically alter molecular transport behavior. Here, we systematically explore the role of nanoparticle sizes from 12 to 130 nm on polymer dynamics and permeability in a series of cross-linked poly(ethylene glycol)/silica nanocomposite membranes. The nanocomposites are well-dispersed and display excellent homogeneity throughout. Size-dependent broadening of the T_g indicates strong attractive interactions especially at high surface area loadings, which lead to deviations in permeability not captured by Maxwell's model. Chemical modifications of silica at this interface can yield significantly different polymer dynamics than previously observed with enhanced transport and mechanical properties.

Norman Su
Univ of California - Berkeley

Date submitted: 14 Nov 2014

Electronic form version 1.4