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Comparison of the Glass Transition Temperature (Tg)-Confinement Effect in Real and Model Polymer Nanocomposites. JOHN M. TORKELSON, PERLA RITTIGSTEIN, LINDA J. BROADBELT, RODNEY D. PRIESTLEY, Northwestern University, Evanston, IL 60208 — Addition of nanoparticles to polymers leads to enhancement of Tg when attractive interactions (e.g., hydrogen bonding) are present at the nanoparticle-polymer interface. Nanoparticle concentration and dispersion play major roles in determining the Tg enhancement. Unfortunately, characterization of dispersion by transmission electron microscopy is difficult and tedious. Here we show by determination of the Tg-confinement effect in "model" polymer-silica nanocomposites (NCs), i.e., a polymer film of known thickness with two silica substrates supporting both sides of the film, that it is possible to characterize the effect of interparticle spacing on Tg and the approximate interparticle spacing in real polymer-silica NCs. Studies of model poly(2-vinyl pyridine) (P2VP)-silica NCs with 200-900 nm interlayer spacing reveal that a significant Tg enhancement is observed at a 500-nm interlayer spacing and that the Tg enhancement exceeds 20 K at a 200-nm interlayer spacing. Studies of model poly(methyl methacrylate) (PMMA)-silica NCs exhibit lesser Tg changes at smaller interlayer spacing. By comparison of Tg enhancements in real and model NCs, a 5 K Tg enhancement in a 0.4 vol% silica-PMMA NC relates to a 100-130 nm interparticle spacing while a 10 K Tg enhancement in a 4 vol% silica-P2VP NC relates to a 300 nm interparticle spacing.

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