Tailoring the Glass Transition Temperature of Polymer Nanocomposites

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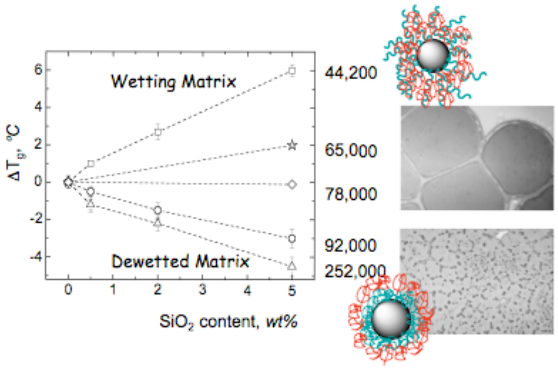
It is well known that an overlayer polymer will dewet a chemically identical brush layer, as long as $M^{graft} << M^{matrix}$, and when the brush grafting density, s, follows $s^2N^{matrix}>>1$ (here M denotes molecular weight, and N the chain length). Similar behavior has been postulated for polymer brushes on curved surfaces. In addition, since the glass transition of a planar thin polymer film is known to be affected by surface interactions, we hypothesized that dispersion of "hairy" nanoparticles into a polymer matrix will allow us to readily tune the thermomechanical properties of the resulting nanocomposite. Using silica nanoparticles with 110,000 molecular weight grafted polymer (graft density of .27 chains/nm^2, we were able to control the wettability of the matrix by controlling its molecular weight and thus were able to tailor the glass transition temperature of polystyrene.[1] Matrix polymers that wetted the nanoparticles showed an increase in glass transition temperature, and those that were non-wetting showed a decrease in glass transition temperature. *This is the first study showing a direct correlation between wetting and changes in glass transition temperature and provides a new avenue for controlling polymer T_g.*



[1] A. Bansal, H. Yang, C. Li, B.C. Benicewicz, S.K. Kumar, L.S. Schadler, "Wetting behavior of polymers on surfaces of nanoparticles grafted with polymer brushes," *J. Polymer Science, Part B. Polymer Physics*, 2006.

Molecularium^{TM} Goes Across the Nation

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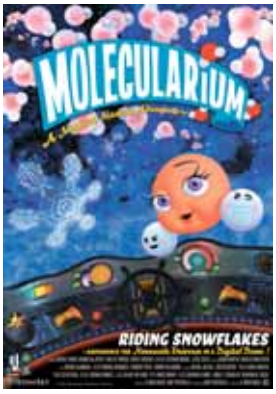

Molecularium: "Riding Snowflakes" opened at the Chabot Space and Science Center over Thanksgiving Weekend 2005 and since then has had 4000 visitors. Chabot is a beta test site and they compiled assessment data on what the audience learned. This third-party evaluation of "Riding Snowflakes" confirmed the effectiveness of this educational project. The show is now licensed to three distributors (e-Planetarium, Sky-Skan, and Spitz) and will begin appearing around the nation. "Riding Snowflakes" is a 23-minute digital-dome theater movie, which is a magical musical adventure into the world of molecules. The show teaches viewers that "everything is made of atoms and molecules" and about three states of matter, solid, liquid, and gas. It first opened on February 4, 2005 at the Children's Museum of Science and Technology in Troy, NY. Interactive games, multimedia, and teaching guides are available online at www.molecularium.com.