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Tuning the Glass Transition Temperature over 100 K using Polymer-Polymer Interfaces CONNIE B. ROTH, Dept. of Physics, Emory University, RODNEY D. PRIESTLEY, SOYOUNG KIM, Dept. of Chemical and Biological Eng., Northwestern University, JOHN M. TORKELSON, Dept. of Chemical and Biological Eng. and Materials Sci. and Eng., Northwestern University — During the past decade considerable research has focused on the impact of the free surface and substrate interactions on the glass transition temperature (Tg) in nanoconfined geometries. For example, the large (up to 80 K) Tg reductions that have been observed in free-standing films indicate that we still have much to learn about the nature of the glass transition. Here we focus on an entirely different kind of interface, a polymer-polymer interface, which we show can have an even stronger impact on the Tg dynamics than a free surface. We demonstrate that the interactions across a narrow polymer-polymer interface are sufficient to tune the Tg of a single polymer material by over a 100 K simply by changing the type of polymer in the adjoining layer. The cooperative segmental dynamics of the two immiscible polymers are strongly coupled over length scales of several tens of nanometers. These results have significant impact on our understanding of the glass transition in multilayer films and nanostructured polymer blends with large amounts of polymer-polymer interface. These findings also suggest new methods for controlling polymer properties in nanoconfined geometries.

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