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Extended Tg Gradient Profile Across a Glassy-Rubbery Polymer-Polymer Interface with an 80 K Tg Difference ROMAN BAGLAY, CONNIE ROTH, Department of Physics, Emory University, Atlanta, GA — For decades Tg in confined systems has been studied with the hopes of uncovering the length scales that impact the glass transition. However, understanding length scales of Tg gradients near a free surface have been hampered by limitations of how to treat the enhanced mobility at the free surface theoretically. Here, we use a glassy-rubbery polymer-polymer interface to establish an 80 K Tg gradient from one well-defined Tg value to another. Multilayer films of high molecular weight polystyrene (PS) and poly(n-butyl methacrylate), a weakly immiscible system with a 7 nm interfacial width, are constructed. Ultrathin (10-15 nm) pyrene-labeled layers are inserted into the multilayer structure at different positions (z) from the glassy-rubbery interface. Temperature-dependent fluorescence intensity is collected to determine the local Tg(z) at a given position z from the interface. Using a series of different samples, we are able to map the Tg(z) profile across this glassy-rubbery interface. Our work reveals an asymmetric local mobility gradient propagating hundreds of nanometers away from the interface into the glassy PS side before bulk PS Tg is recovered. These results demonstrate that cooperative segmental Tg dynamics can be coupled across long length scales spanning multiple cooperatively rearranging regions (CRRs).

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