Abstract Submitted
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The local segmental dynamics of polymer thin films.[1] C.M. ROLAND, RICCARDO CASALINI, Naval Research Laboratory, DANIELE PREVOSTO, MASSIMILIANO LABARDI, University of Pisa, LEI ZHU, ERIC BAER, Case Western University — The local segmental dynamics of poly(methyl methacrylate) (PMMA) in multi-layered films with polycarbonate was investigated using dielectric spectroscopy. The segmental relaxation time decreased with layer thickness down to 4 nm. However, two measures of the cooperativity of the dynamics, the breadth of the relaxation dispersion and the dynamic correlation volume, were unaffected by the film thickness. This absence of an effect of geometric confinement on the cooperativity, even when the confinement length scale approaches the correlation length scale, requires an asymmetric correlation volume; i.e., correlating regions having a string-like nature. To further probe the effect of layering on the segmental dynamics, we measured the segmental dynamics of poly(vinylacetate) thin films in contact with variously an aluminum interface, an incompatible polymer, and air (free surface). From local dielectric relaxation measurements using an AFM tip, the dynamics were observed to be faster in all thin film configurations compared to the bulk. However, no differences were observed for the various interfaces; capping the thin films with a rigid material accelerated the segmental motions equivalently to that for an air interface. This insensitivity of the dynamics to the nature of the interface affords a means to engineer thin films while maintaining desired mechanical properties.

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