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Free surface facilitation of the dynamics of entangled polymer films ETHAN GLOR, ZAHRA FAKHRAAI, Univ of Pennsylvania — Recent work in polymer physics shows that the structural relaxation time near a free surface of a thin polystyrene film is significantly different from that of the bulk polymer. This can have a large influence on their properties. For instance, studies have shown that polystyrene thin films exhibit a decreased glass transition temperature as the thickness decreases below 60 nm. A puzzling aspect of this phenomenon is that most studies indicate that there is no molecular weight dependence on T_g reduction in supported films, while the same phenomenon in free-standing polystyrene films shows a strong molecular weight dependence. In this study, we use cooling-rate dependent T_g measurements to indirectly probe the relaxation dynamics of thin polystyrene films, and show they are directly influenced by the dynamics of the free surface. Furthermore, we show that the relaxation dynamics of supported polystyrene films slow down slightly as the molecular weight of polystyrene is increased. Finally, this study elucidates the importance of the time scale of the measurement on the magnitude of the observed T_g reduction, and discusses the nature of the apparent onset of observable interfacial effects.

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