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Dramatic role of fragility in determining the magnitude of T_g perturbations to ultrathin film layers and near-infinitely dilute blend components CHRISTOPHER EVANS, JOHN TORKELSON, Northwestern University, NORTHWESTERN UNIVERSITY TEAM — Using fluorescence, we measure the glass transition temperatures (T_g) of ultrathin (11-14 nm) polystyrene (PS, bulk $T_g = 103$ °C) layers which can be tuned over ~ 80 °C when sandwiched between two bulk neighboring layers of poly(4-vinyl pyridine) (P4VP), polycarbonate, poly(vinyl chloride) (PVC) or poly(tert-butyl acrylate). Between P4VP, an ultrathin PS layer has its dynamics slaved and reports the T_g of bulk P4VP. In contrast, an ultrathin PS layer is weakly perturbed ($T_g = 97$ °C) when placed between PVC. These perturbations to the PS T_g become evident even for layers 10s of nanometers in thickness. Additionally, binary blends were prepared with 0.1 wt% PS components surrounded by the same neighboring polymers as in the trilayers. The T_g reported by an ultrathin PS layer and a 0.1 wt% PS blend component are the same for a given polymer pair indicating that the T_g perturbations in these two systems arise from a common physical origin. The strength of perturbations to PS correlate with the fragility of the neighboring domain in both blends and multilayers indicating that it is a key variable in determining the strength of T_g-confinement effects. Fragility also tracks with the magnitude of T_g-confinement effects observed in single layer polymer films supported on silicon wafers.

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