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Impact of systematic chain architecture changes on the glass transition and modulus of thin polymer films BRYAN VOGT, University of Akron, JESSICA TORRES, Intel, CHRISTOPHER STAFFORD, NIST, RICHARD REGISTER, Princeton University, DAVID UHRIG, Oak Ridge National Laboratory — We will discuss two systems that significantly impact the thin film behavior with minor changes in chemistry and chain architecture. First, two polymers based on 5-(2-phenylethylnorbornene) are examined. Depending on the polymerization route chosen, the resulting polymer backbone is comprised of either bicyclic (norbornyl) units, which leads to a relatively rigid polymer with a high bulk T_g, or monocyclic (cyclopentyl) units, which leads to a more flexible structure with a lower bulk T_g. The modulus and T_g of the rigid bicyclic polymer is thickness independent down to <10 nm, whereas the modulus of the more flexible monocyclic polymer decreases with decreasing thickness. By hydrogenation of the pendant phenyl ring to the cyclohexyl counterpart, we illustrate that minor changes in the relative flexibility of the side chain do not impact the observed thin film behavior. Second, a series of polystyrene with controlled branching including linear, comb, 6-arm star and centipede. Based upon the molecular mass of the arms, the comb polymer has a significantly larger persistence length and interestingly exhibits only a modest decrease in T_g (9 K) at 5 nm, while the moduli is thickness independent.

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