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Role of free surface and interface effects on viscoelastic properties of ultrathin polystyrene films[1] HEEDONG YOON, GREGORY MCKENNA, Texas Tech University — The surface properties of 20 nm polystyrene (PS) films with different under layer substrates were investigated by employing a silica particle embedment method. The under layer substrates used were PS, poly(2-vinyl pyridine) (P2VP), and poly(methyl methacrylate) (PMMA) with thicknesses ranging from 17 nm to 350 nm. The apparent particle height change was monitored through the use of Atomic Force Microscopy at different experimental temperatures ranging from T_g-10 to T_g+10 ^oC. The Hutcheson and McKenna model [Phys. Rev. Lett. **94**, 076103 (2005)] was applied to the particle embedment depth to obtain the surface rheological temperatures. The results showed that the 20 nm top layer of PS films soften below T_g and stiffen above T_g for the different types of under layer substrates. The rheological temperatures of the 20 nm surface layer PS films were independent of under layer PS thickness in the range from 17 nm to 350 nm. Furthermore, the rheological temperature of the top layer of PS film also showed that different types of under layer substrates such as PS, P2VP, and PMMA can slightly alter the T_g of the top layer of the PS film, but the change was less than 10 K.

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