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Reversible Thermal-Stiffening in Polymer Nanocomposites ERKAN SENSES, PINAR AKCORA, Stevens Institute of Technology — Silica nanoparticles adsorbed with a high glass-transition temperature polymer, PMMA (T_g: 130 °C) are shown to uniformly disperse in a low-T_g polymer matrix, PEO (T_g: -60 °C). These nanocomposites exhibit an unusual reversible liquid-to-solid transition at temperatures above T_g's of both polymers. Mechanical adaptivity of PEO nanocomposites to temperatures underlies the existence of dynamically asymmetric bound layers on particles, and more importantly their impact on mechanical behavior, which sets these materials apart from conventional polymer composites that soften upon heating. Moreover, the growth rate of elastic moduli at temperatures above T_g of PMMA presents an Arrhenius-type relaxation with activation energy well-matching with the α-β merging region of PMMA. These results suggest that the mobility of the surface-bound polymer is essential for reinforcement contrary to commonly accepted glassy-layer hypothesis.

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