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An interface controlled dynamic stiffening in polymer nanocomposites ERKAN SENSES, PINAR AKCORA, Stevens Institute of Technology — Tunable interfaces between inorganic and organic phases determine the mechanical behavior of responsive and adaptive composites. We present that bonding/debonding of chains on nanoparticles can be modulated with extensive periodic strains. Mechanical response of an attractive model polymer composite, poly(methyl methacrylate) filled with silica nanoparticles of sizes 13 nm and 56 nm, is monitored in series of deformation-resting experiments allowing us to tune the interfacial strength of polymer. We show that this deformation process exhibit unusual stiffening of composites as the matrix polymer is bound to the surface stronger on removal of strain. Mechanical response during the recovery together with SANS and FTIR analysis of the composites at different states of deformation reveal that this behavior arises from enhancement in the entanglement of chains at interfaces. We studied the effects of strain amplitude, confinement parameter (ID/2Rg) and resting time and found that the stiffening is manifest only after large strains. This behavior offers an 'on demand' reinforcement properties to polymer nanocomposites, implying that the composites with attractive interfaces can self-stiffen as needed.

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