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Enhanced Mechanical Properties of Nanoparticle Networks Cross-Linked by Biomimetic Catch Bonds BADEL L. MBANGA, BALAJI V.S. IYER, VICTOR V. YASHIN, ANNA C. BALAZS, Chemical Engineering Department, University of Pittsburgh, Pennsylvania 15261, USA — The tunable behavior of cross-linked networks of Polymer-Grafted Nanoparticles (PGNs) makes them excellent candidates for designing novel materials with enhanced mechanical properties. The building block of a PGN network is a nanoparticle with grafted polymer chains whose free ends' reactive groups can form bonds with the end chains on the nearby particles. We use computer modeling to study the tensile behavior of 3D samples, in which some fraction of cross-links is formed through the biomimetic "catch" bonds. In contrast to conventional "slip" bonds, the catch bonds might become stronger under an applied force due to transitions between two conformational states. The mechanical properties of the PGN networks are shown to exhibit a drastic improvement upon introduction of the catch bonds into the network. We discuss how ductility, toughness, and rate of strain recovery of the network depend on the catch bond content.

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