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Role of Stretchable Arms, Grafting Density and Parallel Reformable Bonds in the Self-Healing of Cross-Linked Star Nanogel Particles BALAJI IYER VAIDYANATHAN SHANTHA, ISAAC SALIB, VICTOR YASHIN, GERMAN KOLMAKOV, University of Pittsburgh, KRZYSZTOF MATYJASZEWSKI, Carnegie Mellon University, ANNA BALAZS, University of Pittsburgh — We investigate the role of stretchable and reformable bonds in the self-healing of a network formed by star-like nanogel particles. The individual particles of the network are composed of a cross-linked gel core and a corona of grafted polymeric arms with sticky end groups. The sticky groups in the coronas of adjacent particles interact to form multiple labile bonds (up to N) that lead to the formation of the nanogel network. Interaction between soft colloids with polymeric arms is combined with the Bell model for rupture and formation of bonds to model the interaction of array of particles. While the stretch of the bonds is captured through the bond spring constant (k) and cutoff radius for bond breaking (rc), the equilibrium distance (req) at which the labile bonds reform is obtained from the corona thickness. We show that the presence of stretchable arms allows for rearrangements leading to either increase or decrease of the strength and ductility of the nanogel network depending on the grafting density. We also show that while the force required to rupture the nanogel network is proportional to the number of parallel bonds (N), the ductility is a more complex function of N.

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