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Harnessing Labile Bonds between Nanogels Particles to Create Self-Healing Materials GERMAN KOLMAKOV, Chemical Engineering Department, University of Pittsburgh, Pittsburgh, PA 15261, USA, KRZYSZTOF MATYJASZEWSKI, Department of Chemistry, Carnegie Mellon University, Pittsburgh, PA, 15213, USA, ANNA BALAZS, Chemical Engineering Department, University of Pittsburgh, Pittsburgh, PA 15261, USA — Using computational modeling, we demonstrate the self-healing behavior of novel materials composed of nanoscopic gel particles that are interconnected into a macroscopic network by both stable and labile bonds. Under mechanical stress, the labile bonds between the nanogels can break and readily reform with reactive groups on neighboring units. This breaking and reforming allows the units in the network to undergo a structural rearrangement that preserves the mechanical integrity of the sample. The stable bonds between the nanogels play an essential role by forming a backbone that provides a mechanical strength to the material. The simulations show that just a relatively small fraction of such labile bonds (roughly 15%) are needed to prevent the catastrophic failure of the sample. The findings provide guidelines for creating high-strength, self-healing materials.

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