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Utilizing ATRP to Design Self-Regenerating Polymer Gels XIN YONG, University of Pittsburgh, SAADYAH AVERICK, Carnegie Mellon University, OLGA KUKSENOK, University of Pittsburgh, KRZYSZTOF MATYJASZEWSKI, Carnegie Mellon University, ANNA BALAZS, University of Pittsburgh — Using newly developed computational approaches, we design a gel system capable of re-growth after a substantial section of the material was cut away. Atom transfer radical polymerization (ATRP) is utilized to form gels with preserved "living" chain ends and residual unreacted cross-linking groups. When this "living" gel is cut, these active species are exposed to a solution containing monomer, crosslinker, initiator and catalyst. A "repairing" polymerization occurs from both the new initiators introduced in the outer solution and the reactive chain ends present at the cut site. This new polymerization results in a covalent linkage between the initial living gel and the new gel prepared in the outer solution, and the connection is promoted by the presence of residual cross-linking groups. By measuring the diffusion of the outer solution into the cut gel and characterizing the width and strength of the interface between the initial and new gels, we identify the optimum parameters that yield a strong interface between the gel layers. Our simulations results are in good agreement with our experimental studies. This strategy not only regenerates "injured" gels, but also offers a novel means to engineer multi-layered composite gels.

Xin Yong
University of Pittsburgh

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