

Mechanophore-based cross-links enhancing the toughness of hydrogels

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Abstract:

The high-water content and deformability of hydrogels make them well-suited to tissue engineering and drug delivery applications; however, hydrogels can be brittle and prone to fracture and mechanical wear. Recent work has found that the introduction of scissile cyclobutane-based mechanophore cross-linkers, which react via a facile force-triggered cycloreversion, leads to networks that are up to 9 times tougher than otherwise indistinguishable conventionally cross-linked analogs. This improvement makes the materials less prone to fracture and wear without changing their performance. In this work, we investigate how mechanophore-based cross-linking strategies can be applied to improve the mechanical resilience of hydrogel systems. By incorporating cyclobutane mechanophore cross-linkers into hydrogels, we examine how force-responsive molecular motifs influence network mechanics and resistance to fracture. In the long term, such material platforms might allow the influence of local fracture and tearing on the fate of cells embedded within them to be probed.