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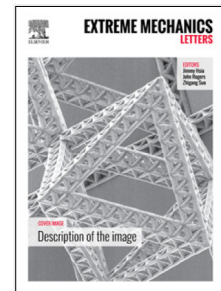
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Fatigue fracture of hydrogels

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Abstract. Rapid advances are taking place to develop hydrogels of high stretchability and toughness, but fatigue fracture has not been studied for any hydrogels. This negligence hinders the development of hydrogels and their applications. Here we initiate a study of fatigue fracture of hydrogels. We choose polyacrylamide hydrogel as a model material. To place fatigue fracture in context, we apply monotonic, static, and cyclic load, and observe three types of fracture behavior: fast fracture, delayed fracture, and fatigue fracture. Below the critical load for fast fracture, we find two distinct thresholds, one for delayed fracture, and the other for fatigue fracture. The fracture behavior of hydrogel is sensitive to both the amplitude of load and the concentration of water. We relate the experimental observations to the molecular picture of swollen polymer networks. Fatigue fracture of hydrogels is a topic ready for scientific studies and engineering advances.

Keywords

Hydrogel; Delayed fracture; Fatigue fracture; Polyacrylamide

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