

Understanding Hydraulic Fracture through X-Ray Tomography

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Hydraulic fracturing of solids is a rich and complex physical phenomenon. Currently, hydraulic fracturing is a process commonly used in the petroleum industry, in hydrocarbon production and well stimulation. Despite being widely used, hydraulic fracture is still poorly understood, in part because it depends on mechanisms that operate at multiple length scales. Even in homogeneous materials, hydraulic fracture subjected to mixed loading conditions (tension and shear stresses) becomes unstable and displays interesting fragmented fracture patterns. Here we study hydraulic fracture of gels through X-ray tomography (CT). This allows us to obtain the three-dimensional details of the crack-front under such mixed loading. By using the CT image of the crack, we perform finite element analysis to infer fracture mechanics parameters that otherwise will be inaccessible by experimental methods.

