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Fluid-driven fractures in brittle hydrogels NIALL O'KEEFFE, PAUL LINDEN, DAMTP, University of Cambridge — Hydraulic fracturing is a process in which fluid is injected deep underground at high pressures that can overcome the strength of the surrounding matrix. This results in an increase of surface area connected to the well bore and thus allows extraction of natural gas previously trapped in a rock formation. We experimentally study the physical mechanisms of these fluid-driven fractures in low permeability reservoirs where the leak-off of fracturing fluid is considered negligible. This is done through the use of small scale experiments on transparent and brittle, heavily cross-linked hydrogels. The propagation of these fractures can be split into two distinct regimes depending on whether the dominant energy dissipation mechanism is viscous flow or material toughness. We will analyse crack growth rates, crack thickness and tip shape in both regimes. Moreover, PIV techniques allow us to explore the flow dynamics within the fracture, which is crucial in predicting transport of proppants designed to prevent localisation of cracks.

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