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Visualizing 3D fracture morphology in granular media MARIE-JULIE DALBE, Civil And Environmental Engineering, Massachusetts Institute of Technology, RUBEN JUANES, Civil And Environmental Engineering, MIT — Multiphase flow in porous media plays a fundamental role in many natural and engineered subsurface processes. The interplay between fluid flow, medium deformation and fracture is essential in geoscience problems as disparate as fracking for unconventional hydrocarbon production, conduit formation and methane venting from lake and ocean sediments, and desiccation cracks in soil. Recent work has pointed to the importance of capillary forces in some relevant regimes of fracturing of granular materials (Sandnes et al., Nat. Comm. 2011), leading to the term hydro-capillary fracturing (Holtzman et al., PRL 2012). Most of these experimental and computational investigations have focused, however, on 2D or quasi-2D systems. Here, we develop an experimental set-up that allows us to observe two-phase flow in a 3D granular bed, and control the level of confining stress. We use an index matching technique to directly visualize the injection of a liquid in a granular media saturated with another, immiscible liquid. We determine the key dimensionless groups that control the behavior of the system, and elucidate different regimes of the invasion pattern. We present result for the 3D morphology of the invasion, with particular emphasis on the fracturing regime.

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