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Impact of wettability on two-phase displacement patterns in granular media RUBEN JUANES, MATHIAS TROJER, MICHAEL SZULCZEWSKI, Massachusetts Institute of Technology, RAN HOLTZMAN, Hebrew University — Two phase flow in porous media controls many natural processes like geological CO2 sequestration, enhanced oil recovery, water infiltration in soil, and methane venting from organic-rich sediments. While the wetting properties of rocks can vary drastically, the effect of wettability on fluid displacement in porous media remains poorly understood. Here, we study experimentally how wettability affects the fluid-fluid displacement pattern in rigid granular media within the capillary and viscous fingering regime. We inject a less viscous fluid into a thin bed of glass beads, initially fully saturated with a more viscous one. By keeping all control parameters constant and changing the contact angle of the substrate systematically, we visually explore and quantify the impact of the wetting properties on the invasion morphology. For fixed capillary number, we show that the invasion pattern becomes more stable as the contact angle increases (i.e., as we transition from drainage to imbibition) both in the capillary-fingering and in the viscous-fingering regime. We quantify the dependence of the lengthscale of the instability on contact angle, and propose a mechanistic pore-scale model that explains the macroscopic observations.

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