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DEM Modeling of Coupled Multiphase Flow and Granular Mechanics: Wettability Control on Fracture Patterns YUE MENG, BAUYRZHAN PRIMKULOV, Massachusetts Institute of Technology, ZHIBING YANG, State Key Laboratory of Water Resources and Hydropower Engineering, Wuhan University, FIONA KWOK, University of Hong Kong, RUBEN JUANES, Massachusetts Institute of Technology — The interplay between multiphase flow in a granular medium and the displacement of the grain particles generates a wide range of patterns. The balance between frictional, viscous, and capillary forces has been studied in experiments and simulations, and has helped understanding the underlying mechanisms for a wide range of phenomena, such as methane migration in lake sediments. Here we study fluid-induced fracturing of granular media by hydromechanically coupling a moving capacitor dynamic network model with discrete element modeling. We inject a less viscous fluid into a frictional granular pack initially saturated with a more viscous, immiscible fluid under low capillary number. We study the impact of contact angle and initial packing density, and find four different regimes of the fluid invasion morphology: cavity expansion and fracturing, frictional fingers, capillary invasion, and capillary compaction. We rationalize these simulation outputs by means of a jamming analysis, which allows us to explain fracture initiation as emerging from a jamming transition. We synthesize the analysis in the form of a novel phase diagram of jamming for wet granular media.

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