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Fluid-Driven Deformation of a Soft Porous Medium TYLER LUTZ, LARRY WILEN, JOHN WETTLAUFER, Yale University — Viscous drag forces resisting the flow of fluid through a soft porous medium are maintained by restoring forces associated with deformations in the solid matrix. We describe experimental measurements of the deformation of foam under a pressure-driven flow of water along a single axis. Image analysis techniques allow tracking of the foam displacement while pressure sensors allow measurement of the fluid pressure. Experiments are performed for a series of different pressure heads ranging from 10 to 90 psi, and the results are compared to theory. This work builds on previous measurements of the fluid-induced deformation of a bed of soft hydrogel spheres. Compared to the hydrogel system, foams have the advantage that the constituents of the porous medium do not rearrange during an experiment, but they have the disadvantage of having a high friction coefficient with any boundaries. We detail strategies to characterize and mitigate the effects of friction on the observed foam deformations.

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