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Capturing gas in soft granular media. SUNGYON LEE, Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minnesota, 55455, USA, JEREMY LEE, Department of Engineering Science, University of Oxford, Parks Road, Oxford OX1 3PJ, UK, FENG XU, Department of Mechanical Engineering, University of Minnesota, Minneapolis, Minnesota, 55455, USA, CHRISTOPHER MACMINN, Department of Engineering Science, University of Oxford, Parks Road, Oxford OX1 3PJ, UK — Gas migration through a soft granular material involves a strong coupling between the motion of the gas and the deformation of the material. We study this process experimentally by injecting air into a quasi-2D packing of soft particles and measuring the morphology of the air as it rises due to buoyancy. We systematically increase the confining pre-stress in the packing by compressing it with a fluid-permeable piston, leading to a gradual transition in migration mechanism from fluidization to pathway opening to pore invasion. By connecting these mechanisms quantitively with macroscopic invasion, trapping, and venting, we show that the mixed-mode transitional regime enables a sharp increase in the amount of gas trapped within the packing, as well as much larger venting events. We report our experimental findings and present a simple mechanistic model to rationalize our observations.

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