

Abstract Submitted
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From viscous fingering to bulk elastic fingering in soft materials

BAUDOUIN SAINTYVES, Harvard University, JOHN BIGGINS, Cambridge University, ZHIYAN WEI, Harvard University, SERGE MORA, Université Montpellier 2, OLIVIER DAUCHOT, ESPCI-PARISTECH, L MAHADEVAN, Harvard University, ELISABETH BOUCHAUD, ESPCI-PARISTECH — Systematic experiments have been performed in purely elastic polyacrylamide gels in Hele-Shaw cells. We have shown that a bulk fingering instability arises in the highly deformable confined elastomers. It shares some similarities with the famous Saffman-Taylor instability, but a systematic study shows that surface tension is not relevant. This instability is sub-critical, with a clear hysteretic behavior. Our experimental observations have been compared very favorably to theoretical and finite element simulations results. In particular, the instability wavelength and the critical front advance have been shown to be proportional to the distance between the two glass plates constituting the cell. We have also shown that in Maxwell viscoelastic fluids, one crosses over continuously from a viscous to an elastic fingering instability.

[1] B. Saintyves, O. Dauchot, E. Bouchaud, PRL 2013

[2] J. Biggins, B. Saintyves, Z. Wei, E. Bouchaud, L. Mahadevan, PNAS 2013

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