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Comet-shape deformation and transition to viscous fingering of a miscible circular blob in porous media MANORANJAN MISHRA, Indian Institute of Technology Ropar, India, ANNE DE WIT, Université Libre de Bruxelles, Belgium, SATYAJIT PRAMANIK, Indian Institute of Technology Ropar, India
— We numerically show that a miscible circular blob of viscosity larger than the ambient fluid features three different instability patterns – viscous fingering (VF), lump- and comet-shape instabilities. For a given Péclet number larger than the critical value, VF is observed in a finite range of viscosity contrast between the two fluids. This is in strong contrast to the displacement of a finite slice of miscible fluid in porous media in which instability enhances as viscosity contrast increases. Outside the finite interval of critical viscosity contrast for VF, the circular blob features comet- and lump-shape instabilities. These new dynamics are attributed to competition among the diffusive, convective and viscous forces. Our findings can be very important to understand many physico-chemical dynamics, CO_2 sequestration, reactive dissolution of porous rocks, etc.

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