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Linear stability analysis of immiscible two-phase flow in porous media AMIR RIAZ, HAMDI TCHELEPI, Stanford University — Linear stability analysis of immiscible displacements is carried out for both viscously and gravitationally unstable two-phase flows in porous media with very large adverse viscosity ratios. Capillary dispersion is the proper dissipative mechanism in this case which sets both the preferred length scale and the band width of the spectrum of unstable length scales. The growth rate, the most dangerous and the cutoff wavenumbers, all scale linearly with the capillary number. We show that the instability is governed by fluid properties across the shock rather than those across the full Buckley–Leverett profile. The shock total mobility ratio provides a sufficient condition for the onset of instability; however, it is not an appropriate criterion for predicting the magnitude of the growth rate, particularly for large viscosity ratios. The details of the relative permeability functions are observed to have a significant influence on the stability characteristics. For neutrally buoyant flows the maximum growth rate scales linearly with the viscosity ratio while the most dangerous and the cutoff wavenumbers scale with the square root of the viscosity ratio.

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