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Particle-induced viscous fingering

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An inclusion of non-colloidal particles in a Newtonian liquid can fundamentally change the interfacial dynamics and even cause interfacial instabilities.In this talk,we report a particle-inducedfingering instability when a mixture of particles and viscous oil is injected radially into a Hele-Shaw cell.Our experimental results showthat the onset and characteristics of fingering are most directly affected by the particle volume fraction but also depend on the ratio of the particle diameter to gap size. In particular, the formation of a particle band is observed on the interface only when the particle diameter is comparable to the channel gap thickness.This work demonstrates the complex coupling between suspensions and fluid-fluid interfaces and has broad relevance in suspension processing, particle self-assembly, and oil recovery processes.The physical mechanism behind the instability and a quantitative model are alsodiscussed.