

Abstract Submitted
for the DFD17 Meeting of
The American Physical Society

Self-similarity in particle accumulation on the fluid-fluid interface YUN CHEN, FENG XU, Department of Mechanical Engineering, Texas A&M University, SUNGYON LEE, Department of Mechanical Engineering, University of Minnesota — When the mixture of viscous oil and non-colloidal particles displaces air between two parallel plates, the shear-induced migration of particles leads to the gradual accumulation of particles on the advancing oil-air interface. This particle accumulation results in the fingering of an otherwise stable fluid-fluid interface. While the previous works by Xu and colleagues have focused on the resultant instability, one unexplored yet striking feature of the experiments is the self-similarity in the concentration profile of the accumulating particles. In this talk, we model the self-similar particle profiles mathematically, by considering the depth-averaged particle transport equations and the suspension balance model. The method of asymptotic matching is used to combine the key physical effects – the shear-induced migration far upstream of the interface and the secondary flow near the interface, in a mathematically tractable way.

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Date submitted: 28 Jul 2017

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