Abstract Submitted
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The effect of permeability gradients on immiscible displacement in Hele-Shaw flows[1] TALAL AL-HOUSSEINY, Chemical and Biological Engineering Department, Princeton University, PEICHUN TSAI, ZHONG ZHENG, HOWARD STONE, Mechanical and Aerospace Engineering Department, Princeton University, COMPLEX FLUIDS GROUP TEAM — In heterogeneous media, it is well known that when a fluid of high viscosity displaces a less viscous fluid, the interface can still be unstable and exhibit finger-like patterns due to capillary fingering. Motivated by porous media flows in natural geological formations, we consider homogeneous displacement in a Hele-Shaw cell subjected to a permeability gradient. The permeability gradient is introduced by linearly varying the Hele-Shaw cell depth. We study how capillary forces can affect interfacial stability in the presence of the gradient via linear stability analysis. Depending on the system, we find that surface tension can either have a stabilizing or a destabilizing role. We report the emergence of an important dimensionless parameter–the ratio of the permeability gradient to the capillary number–that determines the stability of the interface along with the well-studied viscosity ratio. Experiments testing the theoretical findings will also be presented.

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