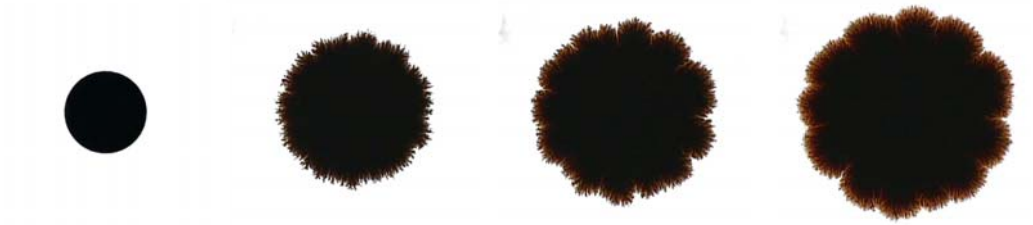
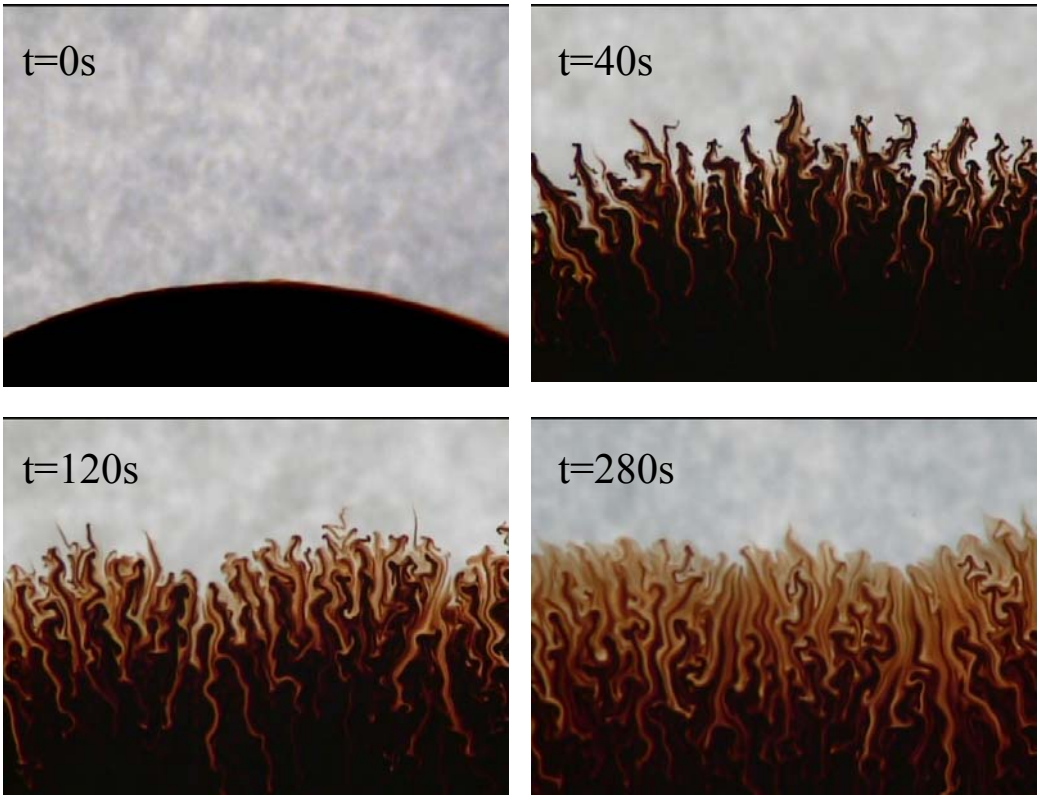


t=0s t=40s t=120s t=280s



Labyrinthine instabilities of a miscible magnetic droplet in a Hele-Shaw cell

Submitted by
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Labyrinthine instabilities of a miscible magnetic drop in a Hele-Shaw cell are presented. An oil-based drop of ferrofluid (Ferrotech EMG905, saturated magnetization *Ms=400 gauss* and initial susceptibility χ=3), is surrounded by fully miscible diesel oil. The width of cell and original diameter of drop are *1 mm* and *24.6 mm*, respectively. A perpendicular magnetic field strength of *H=187 gauss* is applied to the cell. A divider is initially placed between the drop and surrounding fluid to prevent from premixing. The ferrofluid is pre-magnetized. Consequentially, the divider is removed at time t=0. The sequential morphologies of drop are recorded by a CCD camera.

Shown in the top row are the snapshots at various times t=0, 40, 120 and 280s, and their correspondent enlarged views on the mixing interface are shown in row 2 and 3. The presence of field provides dipolar forces and causes vigorous interfacial fingering instabilities, or so-called labyrinthine instability. Because of both the diffusion and fingerings, the drop appears visible expansion as figures shown in the top row. After t=120s, many dominant big waves are evolved. As time proceeds, the diffusive effects enhance dispersion and gradually smear off the small fingering structures. The effects of strong dispersion can be identified by the enlarged views at t=40s (row 2) and t=280s (row 3). We would like to notice that even the labyrinthine instability is well experimentally studied for immiscible interfaces, detailed results in fully miscible situations have yet been presented before.