Numerical simulation of Labyrinthine instabilities on miscible magnetic fluids in a Hele-Shaw cell

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ABSTRACT

The labyrinthine fingering instabilities of miscible magnetic fluids on a Hele-Shaw cell are simulated high order numerically. Labyrinthine Fingering instabilities perturbed by the magnetic dipolar forces of under a uniform perpendicular magnetic field.Besides the influence of magnetic forces make miscible interfaces unstable, the interests in miscible interfaces also include the findings of the non-conventional stresses as like as surface-tensor in immsicible, or so-call Korteweg stresses, and great similarities of fingering patterns with the effects of interfacial-tension liked Korteweg stresses to their immiscible equivalents are found. The labyrinthine fingering instabilities and the effects of the dynamic surface tension on miscible interfaces are confirmed to mimic the surface tension.In an additional, this thesis also focuses on miscible magnetic fluids droplet on a rotating Hele-Shaw cell. The perpendicular magnetic field, the centrifugal, the more viscosity all can induced labyrinthine fingering instabilities are enhanced, but the azimuthal magnetic field of current-carry wire, Coriolis force of rotating effect, Korteweg stresses on misicible interfaces tend to damp down the instabilities. Those influences are also demonstrated quantitatively, which confirms the opposite effects to the interfacial fingerings instability of miscible magnetic fluids.

Keywords : Hele-Shaw cell, labyrinthine fingeringinstabilities, magnetic fluids, Korteweg stresses, Coriolis force

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