Experiment of Labyrinthine Fingering Instabilities in Magnetic Fluids

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ABSTRACT

Labyrinthine fingering phenomena in a circular geometry are observed by a CCD camera and studied for a magnetic fluid submitted to a perpendicular magnetic field. Magnetic fluid is injected at the center of a Hele-Shaw cell filled with air for the immiscible case and diesel oil for the miscible case, respectively. The instability of the interface between the air.magnetic fluid and diesel oil.magnetic fluid is more vigorous due to the presence of a magnetic field. The threshold of the instability, number of fingers and the corresponding growth velocity of fingers are magnetic field dependent. In the study of the immiscible cases, the normalization gyration diameters obtained for the high magnetic field with a small diameter of magnetic fluid are nearly the same as those for the low magnetic field with a larger diameter of magnetic fluid. The Hele-Shaw cell with a larger thickness has a higher velocity of finger growth. The preliminary results of the miscible experiment are also presented.The interfaces of immiscible and miscible cases are completely different. Diffusion and convection are observed at the miscible interfaces. Both diffusion and convection of magnetic particles in the miscible experiment play important roles.

Keywords : labyrinthine instabilities   miscible magnetic fluids   Hele-Shaw cell

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