PERIODIC FORCING OF NORMAL SAFFMAN-TAYLOR FINGERS: EXPERIMENTAL RESULTS

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When a viscous fluid confined between two parallel plates is displaced by a less viscous fluid, the interface between both fluids is unstable and viscous fingers are formed. This is the well known Saffman-Taylor instability. Last years, experimental studies (1,2) and simulations (3,4) studied instabilities of the apparent flat sides of the normal finger.
In our previous work (2) we observed that fluctuations in the spatial separation of the plates was the responsible of the lateral instability. This results were predicted by simulation studies (3,4). These lateral instabilities appear as a result of the perturbation of the finger tip. The reason for which these instabilities where not observed in previous works is that they appear very far from the finger tip. It is necessary to have very long fingers to observe the instability.
Last, we studied the effect of a periodic forcing in a normal Saffman-Taylor finger. In our experiments we obtain a normal finger withdrawing liquid at a constant velocity. Once the stationary finger is completely developed we add an oscillatory air flux to the constant liquid flux. We find that, according to the simulation studies, the finger develops a low amplitude-long wavelength lateral instability which undergoes a process of selection. We study a wide range of frequencies to identify the different regimes that characterize the instability.

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