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Deviation from capillary number scaling of nonlinear viscous fingering formed by the injection of Newtonian surfactant solution RYOHEI TANAKA, REIKO TSUZUKI, Student, TAKAHIKO BAN, Lecturer, YUICHIRO NAGATSU, Associate Professor — An experimental study of immiscible viscous fingering (VF) with Newtonian fluids is explored in this research. Previous studies show that immiscible VF is dominated by the capillary number defined as the ratio between the viscous force and the interfacial tension, and that the finger width decreases with increasing capillary number. However, in the present study, phenomena contrary to these rules were observed: wider fingers occurred in the surfactant solution system compared to those in the water system, in the nonlinear stage of VF evolution, despite the fact that the capillary number had the same value for both systems. In addition, even though the surfactant system had a higher capillary number than the water system, wider surfactant fingers were observed. A possible mechanism explaining this is discussed by comparing with previous studies regarding VF with surfactants. The present study indicates that the capillary number does not control the nonlinear VF width in the surfactant system. Our results and discussion can be used to contribute to the establishment of well-controlled processes for surfactant flooding and the recovery of residual NAPL in aquifers.

Ryohei Tanaka
Student

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