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Viscous fingering and dynamic saturation–pressure curves in two-dimensional porous media

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We present results from primary drainage experiments in quasi-twodimensional porous models. We study the unstable displacement of a viscous liquid by air in transparent models that allow the displacement process and structure to be monitored in space and time. Primary drainage experiments are carried out under various displacement velocities.

By combining detailed information on the displacement structure with global measurements of pressure, saturation and the capillary number Ca, we obtain a scaling relation that relates pressure, saturation, system size, and capillary number. This scaling relation allows pressure–saturation curves for a wide range of capillary numbers to be collapsed on the same master curve. We also show that in the case of primary drainage, the dynamic effects in the capillary pressure–saturation relationship commonly observed on partially water-saturated soil samples can be explained by the combined effect of capillary pressure along the invasion front of the gaseous phase, and pressure changes resulting from viscous forces in the displaced wetting liquid phase.

Reference:

G. Løvoll et al., *Trans. Porous Med.*, in press (2010)