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Capillary-controlled instability in immiscible, parallel flow in porous media[1] THOMAS RAMSTAD, ALEX HANSEN, Department of Physics, NTNU, N-7491 Trondheim and Numerical Rocks AS, Stiklestadveien 1, N-7041 Trondheim, Norway — When two immiscible fluids flow in parallel in a strongly wetted porous medium the global interface separating them tend to be kept in place by local capillary barriers. However, above a certain threshold in the flow rate, the separating interface may become unstable and mobilized. We study this instability theoretically by using a two-dimensional network as a model for porous media in a flow regime where capillary forces cannot be neglected. It is found that a boundary zone with a sharp saturation profile occurs between the regions originally saturated with either a wetting or a non-wetting phase. This zone has a well defined width and moves with constant speed towards the non-wetting region. In the opposite direction, a current of non-wetting bubbles is set up, but wetting bubbles into the non-wetting region are absent. This behavior is genuinely different from shear-induced Kelvin-Helmholtz instabilities.

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