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The stability of capillary climbing flows in porous media opposed by gravity force B. MARKICEVIC, H.K. NAVAZ, Kettering University — The experimental and numerical data reveal that the capillary climb opposed by gravity force starts as a stable flow for low climbing height, which is followed by unstable flow and multiphase pattern for higher climbing heights. For the stable flow, a sharp interface between the liquid and gas phase exists, which transforms later into a flow front of increasing thickness as climbing progresses. The flow front thickness is calculated from the difference between instantaneous climbing height and maximum stable climbing height. We carry out the analysis of capillary climb flow stability using the capillary and the Bond number, as well as using the generalized Bond number. The critical generalized Bond number defines the condition for which the interface transforms to the flow front. For three distinct porous media consisting of glass beads, and having a thin layer of low permeable material at the bottom of the glass beads columns, the values of critical generalized Bond number and the exponents in the power law of flow front thickness as a function of the generalized Bond number are compared. Furthermore, the flow stability analysis is extended to two additional cases in which a low-permeable layer is removed from the column bottom, and the case of pure capillary flow (without gravity). The corresponding critical generalized Bond numbers and the power law exponents are compared.

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