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Capillary climb dynamics in the limits of prevailing capillary and gravity force H.K. NAVAZ, B. MARKICEVIC, Kettering University, B. BIJELJIC, Department of Earth Science and Engineering, Imperial College — The dynamics of the capillary climb of a wetting liquid into a porous medium that is opposed by gravity force is studied numerically. The capillary network model, in which an actual porous medium is represented as a network of pores and throats, is used. The numerical results for the capillary climb reveal that there are at least two distinct flow regimes. The first regime is characterized by the capillary force being much larger than the gravity force. In this regime the Washburn solution can be used to predict the changes of climbing height over time. In the second regime the capillary and gravity forces become comparable, and one observes a slower increase in the climbing height as a function of time. The numerical results from this study, expressed as the climbing height as a power law function of time, indicate that the two powers, which correspond to the two distinct regimes, differ significantly. The comparison of the powers with experimental data indicates a good agreement. Furthermore, the power value from the Washburn solution is analyzed, where it should be equal to one half for purely capillary force driven flow. This is in contrast to the value of around 0.43 that is found experimentally. We show from the numerical solution that this discrepancy is due to the momentum dissipation on the liquid interface.

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