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Effect of meniscus contact angle during early regimes of spontaneous capillarity in nanochannels[1] N.K. KARNA, ELTON OYARZUA, University of Concepcion, J.H. WALTHER, Technical Univeristy of Denmark, HARVEY ZAMBRANO, University of Concepcion — In capillary imbibition, the classical Lucas-Washburn equation predicts a singularity as the fluid enters the channel consisting in an anomalous infinite velocity of the capillary meniscus. The Bosanquets equation overcomes this problem by taking into account fluid inertia predicting an initial imbibition regime with constant velocity. Nevertheless, the initial constant velocity predicted by Bosanquet's equation is much greater than experimentally observed. In the present study, we conduct atomistic simulations to investigate capillary imbibition of water in silica nanochannels with heights between 4 and 18 nm. We find that the meniscus contact angle remains constant during the inertial regime and its value depends upon the height of the channel. We also find that the meniscus velocity computed at the channel entrance is related to the particular value of the meniscus contact angle. Moreover, after the inertial regime, the meniscus contact angle is found to be time dependent for all the channels under study. We propose an expression for the time evolution of the dynamic contact angle in nanochannels which, when incorporated in Bosanquets equation, satisfactorily explains the initial capillary rise.

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