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Wetting droplet spread into porous medium: A micro-force balance capillary network solution H.K. NAVAZ, B. MARKICEVIC, Kettering University, Flint MI — An accurate solution of a droplet spread into a porous medium with fluid/solid wetting interaction becomes more important, as application scales shift toward micro- and nano-level. In the capillary network models, an actual porous medium is represented as a network of connected pores, where the rule(s) for droplet spread can be set in different ways. We have developed a general capillary network model with the progression rule based on the setting the micro-force balance at each pore, and the pressure jump condition (capillary pressure) at the phase interface. Using micro-force balance, the local flow due to the capillary force is accounted for. Therefore, in some pores, the flow may retreat rather than only advance throughout the medium. This approach is neither limited by process rate nor interaction type (force balance changes for wetting or non-wetting interaction). From the solution, the phase content (saturation) and the phase pressure are calculated. The parameters as phase permeability, capillary pressure and flow front thickness can be determined. It is also shown how the rate of phase spread changes due to the influence of the local heterogeneities of porous medium. Finally, in order to compare the influence of capillary and viscous forces, the analysis of fluid radial spread into a porous medium with the different inlet pressures is carried out.

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