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The fate of the sessile droplet imprint in porous medium: simultaneous capillary flow and evaporation B.I. MARKICEVIC, H.K. NAVAZ, Kettering University — The fate of a liquid droplet imbibed into a porous medium is formulated as a multiphase problem, and a numerical solution is developed using the capillary network model with a micro-force balance at the liquid|gas interface. Momentum transport - capillary flow, and mass transport - evaporation are solved simultaneously. The physics of the multiphase capillary flow includes the formation of local gas clusters, and liquid ganglia, whose distribution can be determined from the force balance on the gas|liquid interface. The clusters and ganglia distribution is further altered by evaporation. The evaporation tends to shrink the ganglia size and open the gas clusters; both due to the liquid mass loss from the porous medium. Still, the capillarity tends to disperse the liquid back into the regions from where the liquid previously evaporated. In order to quantify the liquid distribution, besides the diffusion coefficient, the dispersion coefficient for the capillary flow is defined. The latter is found from the porous medium permeability, liquid viscosity and capillary pressure. As expected, for a larger dispersion coefficient, the liquid remains closer to the evaporating boundary, and the evaporation rate is higher. The opposite is true for a small dispersion coefficient. Finally, the changes in liquid dispersion influence the liquid persistence time, where this time increases for a liquid dispersed deeper in the medium.

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