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The usage of differential method in determining the multiphase flow transport parameters in porous media BOJAN MARKICEVIC, Pall Corp — The imbibition of wetting liquid by a porous medium starts as a single-phase flow which later transforms into a multiphase flow pattern as wetting liquid progresses into the medium. These capillary flows can be solved using the dynamic capillary network models, where the capillary pressure is calculated at the liquid free interface and progression of the flow front is found from fully resolved velocity and pressure profiles within the wetted domain. From known flow quantities, both phase permeability and capillary pressure are determined as a function of a spatial position in the flow geometry. The phase content (saturation) is also calculated from the numerical solution, and after correlations, the phase permeability and capillary pressure as a function of saturation are found. Two independent checks of this differential method are carried out: the first one being the invariance of the single-phase permeability. For region next to the fluid inlet, it is shown that the pressure gradient and the flow rate are always linearly dependent irrespective of the flow front position downstream. Secondly, the phase permeability and capillary pressure saturation functions should not change throughout the spread, irrespective of the time in which they are measured, but rather they should follow the same dependence on the saturation. The numerical results corroborate this assumption, where the invariant permeability and capillary pressure laws are predicted throughout the imbibation duration. Finally, additional properties of the porous medium can be determined including a minimum saturation of the percolation cluster within porous medium.

Bojan Markicevic
Pall Corp

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