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Influence of the multiphase flow patterns on the transport properties BOJAN MARKICEVIC, Pall Corp, Cortland NY — The capillary network model with the dynamic boundary condition at free interface for displacement flow in porous media is developed, in which the net flow into each pore at the free interface can be less, equal to or greater than zero. The spread of the liquid and form of the liquid flow patterns are resolved in the networks of different sizes and heterogeneity and for two types of the boundary conditions, the constant inlet pressure or constant flow rate. It has been shown that for the constant flow rate boundary condition, the pressure drop throughout the network remains constant due to the pressure increase at the inlet boundary. The constant pressure drop produces the similar flow patterns during the displacement flow, and the saturation remains constant in the flow direction. The liquid saturation in the network is varied gradually by increasing the liquid flow rate at network inlet. For each distinct flow rate, the sizes of the repeating flow pattern and corresponding pressure drop change accordingly. This implies that for sufficiently large networks in which the flow pattern is fully developed, the transport parameters do not depend on the network size. The flow pattern and transport parameters depend on the network heterogeneity, as the dynamic boundary condition changes at the free interface producing a different distribution of the liquid. A continuous development of the flow pattern is also observed for the constant inlet pressure boundary condition, where the pressure drop decreases as liquid advances into the network. Finally, a summary in changes of transport parameters, relative permeability and capillary pressure, is elaborated.

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