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The displacement of immiscible two-phase fluids in a pore doublet system

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Multiphase fluid flow in a pore doublet is a fundamental problem and is important for understanding the transport mechanisms of multiphase flows in porous media. During the displacement of immiscible two-phase fluids in a pore doublet, the transport process is influenced not only by the capillary and viscous forces, but also the channel geometry. In this work, a mathematical model and numerical simulations are presented for the two-phase fluid displacement in a pore doublet with considering the effects of capillary force, viscous force, and the geometric structure. These lead to new and more general analytical and numerical solutions for the pore doublet system, and it is found that the displacement process is dominated by the capillary number, viscosity, and radius ratios. The results can be used to explain and understand the preferential flows in porous media, such as for improving oil recovery from porous media; these are usually observed in oil recovery, groundwater pollution, and the geological sequestration of carbon dioxide.

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