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Asymmetric Two-phase Flows Resistance in Homogeneous and Heterogeneous Anisotropic Porous Microstructure[1] DARIO MAGGIOLO, Chalmers University of Technology, FEDERICO TOSCHI, Eindhoven University of Technology, FRANCESCO PICANO, University of Padova, SRDJAN SASIC, HENRIK STROM, Chalmers University of Technology — Two-phase flows in porous media exhibit anomalous behaviours at low capillary numbers due to the complex mechanism of interaction between flow spatial configuration and topology of the microstructure. In this study, we investigate the asymmetrical nature of the two-phase flow resistance induced by the anisotropic features of the porous microstructure. We perform pore-scale direct numerical simulations of two-phase flows in porous media composed of solid particles with different shapes and orientations, using the Lattice-Boltzmann method. The results indicate that the infiltration of a fluid into a single pore is regulated by the topological traits of the pore, including its anisotropy. These traits determine a geometrical characteristic length of the pore ℓ_p quantifying the flow resistance, which is directional-dependent: if the capillary length $\ell_\gamma = \gamma/p_c$ (i.e. the ratio between surface tension and capillary pressure) falls below the characteristic pore length $\ell_\gamma < \ell_p$, pore infiltration occurs, otherwise the fluid remains trapped. We extend the analysis to heterogeneous anisotropic microstructure in order to investigate the effect of the spatial configuration of the pores on the global flow resistance.

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