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Experimental and Numerical Study of the Dynamic Wetting influence on the Multiphase Flow in a Pore Doublet Model

Tuesday, 1 June 2021 16:25 (15 minutes)

Multiphase flow in porous media is a subject with important technical applications, such as in oil recovery from petroleum reservoirs or in Liquid Composite Molding Processes. In the Liquid Composite Molding and in other applications, macroscopic resin flow is modelled by postulating a multiphase generalization of Darcy's law. However, modelling of multiphase flow remains an important technical challenge and a thorough understanding of pore-scale physics and robust upscaling methods are of great importance.
This work addresses micropore-scale multiphase flow, in which different pressures are defined in each constituent phase with the differences, called capillary pressure, obtained by the micropore geometry and the interfacial tension. Consequently, the study of forces acting inside a fluid or at the interfaces liquid/liquid, liquid/vapor or liquid/solid is very significant to improve the understanding of multiphase flows in porous media [1, 2].
The aim of this work is to study the dependence between the contact-line velocity and the slip length in a Generalized Navier Boundary Condition (GNBC) [3, 4], by confronting numerical simulations to experimental data. Experiments were performed by a liquid/gas cross-flowing mechanism inside a pore T-junction device. For typically small capillary numbers (between 10E-6 and 10E-2) of the continuous shear stream, the dynamic contact angle is found to have a significant effect on the bubble size. This can be explained by the non-uniform displacement of the contact line at the solid wall. Computer fluid dynamics (CFD) simulations of dynamic wetting were performed using a slip model on the substrate. Realistic values of the slip length were chosen by matching the numerical dynamic contact angles obtained by the GNBC Model and experimental ones.

Time Block Preference

Time Block B (14:00-17:00 CET)

References

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