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Unsteady-State Contact Angle Hysteresis during Droplet Oscillation in Capillary Pores: Theoretical Model and VOF Simulation -- Supporting Information

Abstract

Contact angle hysteresis (CAH) is a critical phenomenon that could significantly affect the fate of immiscible bubbles/droplets in vadose zones, nonaqueous phase liquid contaminated aquifers, and saline aquifers for CO_2 sequestration in terms of infiltration patterns and residual trapping mechanisms. When external physical impacts such as oscillatory excitation or pulse forcing are applied, it could result in pinned oscillation of droplets due to this CAH. Conventional steady-state analysis of contact angle could underestimate CAH. As the first time to take unsteady-state effect into consideration, a hydrodynamic analysis is developed in this study to address the unsteady-state CAH theoretically, and validated against volume-of-fluid based computational fluid dynamics simulations. It is found that the unsteady-state CAH of drop can significantly lower the critical acceleration amplitude of excitation to achieve the depinning of contact lines of drops.

Viewing Instructions

Download and view the Data spreadsheet of Figures 2-11.

Keywords and Phrases

Contact Angle Hysteresis; Pinning; Unsteady-State Response; Drop Oscillation; VOF Simulation

Disciplines

Geophysics and Seismology | Geotechnical Engineering

Comments

A spreadsheet titled 'data.xlsx' is contained in this Supporting Information in a separate file. The spreadsheet includes the data of Figures 2-11 in manuscript. In that file, all data are presented in the same tab and ordered in the same sequence as manuscript. The figure legend and x-y titles are also listed. If there is any question about the data file, feel free to contact the corresponding author Dr. Wen Deng.

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[Water Resources Research]

Supporting Information for

Unsteady-state contact angle hysteresis during droplet oscillation in capillary pores: Theoretical model and VOF simulation

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