

Investigating the Effects of Thermal and Surface Energy on the Two-Dimensional Flow Characteristics of Oil in Water Mixture between Two Parallel Plates: A Lattice Boltzmann Method Study

Authors : W. Hasan, H. Farhat

Abstract : A hybrid quasi-steady thermal lattice Boltzmann model was used to study the combined effects of temperature and contact angle on the movement of slugs and droplets of oil in water (O/W) system flowing between two parallel plates. The model static contact angle due to the deposition of the O/W droplet on a flat surface with simulated hydrophilic characteristic at different fluid temperatures, matched very well the proposed theoretical calculation. Furthermore, the model was used to simulate the dynamic behavior of droplets and slugs deposited on the domain's upper and lower surfaces, while subjected to parabolic flow conditions. The model accurately simulated the contact angle hysteresis for the dynamic droplets cases. It was also shown that at elevated temperatures the required power to transport the mixture diminished remarkably.

Keywords : lattice Boltzmann method, Gunstensen model, thermal, contact angle, high viscosity ratio

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