Dynamics of Bubble Rising in Vertical and Inclined Square Channel

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— A stable Lattice Boltzmann Equation (LBE) Model based on the Cahn-Hilliard diffuse interface approach is used to investigate the dynamics of a bubble rising in a vertical and inclined square channel with large density and viscosity ratios. Deformation parameter (Δ) and terminal velocity (U_t) of the bubble are interrelated quantities which depend on non-dimensional numbers such as Bond Number (Bo), Morton Number (Mo) and ratio between bubble diameter and channel width (κ). This study confirms the relationship between κ and Δ and film thickness (δ), as it was reported by previous experimental studies. As κ is increased, higher Δ and smaller δ are exhibited. This finding is independent of the value of Bo and Mo. In addition, an evaluation was performed for inclined channel to relate the non-dimensional value Froude Number (Fr) and the inclination angle (θ) as function of Bo and Mo. For each set of values of Bo and Mo, there is a critical value of θ which corresponds to the highest value of Fr, consequently highest U_t. This finding is consistent previous simulation and experimental results. This study was performed using a range of Bo and Mo, (10^{-5} < Mo < 10^2) and (1 < Bo < 30), and the inclination of the channel is varied from 0˚ to 75˚.

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