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Formation characteristics of Taylor bubbles in power-law liquids flowing through a microfluidic co-flow device

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Abstract

Formation and dynamics of Taylor bubble in power-law liquids flowing through a circular co-flow microchannel are numerically investigated using coupled level set and volume-of-fluid method. Aqueous solutions of polyacrylamide (PAAm) are used as power-law liquids. Influences of PAAm concentration, gas-liquid velocities, and surface tension on bubble characteristics are explored. Various mechanism of bubble breakup are observed in different concentration of PAAm. Based on the bubble length with respect to the channel diameter, two different flow regimes are identified. Flow pattern maps are constructed based on inlet velocities, and scaling laws are proposed to estimate the bubble length.

Keywords: Co-flow microchannel, Taylor bubble, CLSVOF, Power-law liquid, Flow map

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