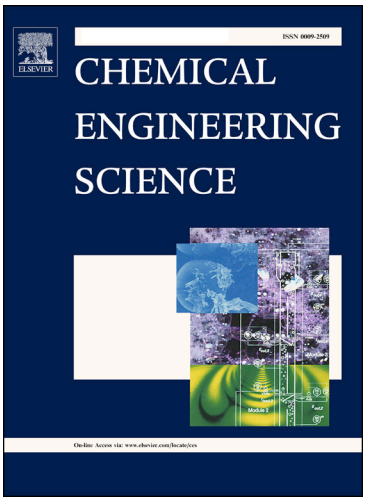

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Dynamic changes in gas-liquid mass transfer during Taylor flow in long serpentine square microchannels

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Abstract

The present work focuses on the hydrodynamics variation and mass transfer characteristics of Taylor flow along long serpentine microchannels with a square cross-section. The volumetric mass transfer coefficient (k_La) is regarded as the transient change value to characterize the gas-liquid mass transfer process of CO_2 in water. All experimental data of Taylor bubble are obtained from 1,000 continuously captured images. An online high-speed imaging method and the unit cell model are adopted in this study. The effects of gas and liquid flow rates, together with microchannel geometry are investigated on Taylor bubble characteristics in terms of length, velocity and the mass transfer performance.

Taylor bubble length shrinks and subsequently plateaus out along the flow direction from the T-junction, resulting in the decrease in Taylor bubble velocity. k_La in a unit cell gradually decreases along the serpentine microchannel, and increases as the channel cross-sectional area decreases. As the gas flow rate increases under a given liquid flow rate, a critical point is found for the evolution of k_La and k_L (that is the

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