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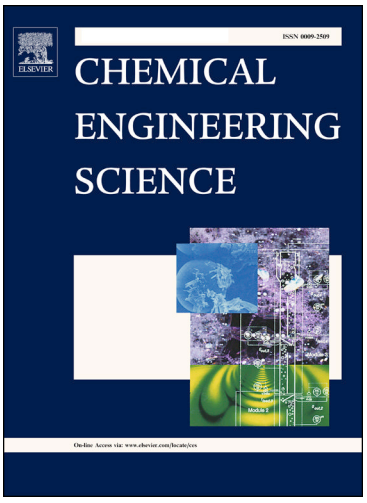

Mixing Time and Mass Transfer of Rising Bubbles in Swarm Turbulence

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Mixing Time and Mass Transfer of Rising Bubbles in Swarm Turbulence

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Abstract

The knowledge of the influence of swarm effects on gas-liquid mass transfer is still limited. In this article, an optical measurement method for the identification of local mixing properties, mass flow rates, and mass transfer coefficients in the wake of rising bubbles with and without swarm turbulence is presented. Two-dimensional concentration data is temporally rearranged to reconstruct a quasi tri-dimensional concentration wake. By this means, the path of the bubble-wake-complex can now be visualized. The analysis shows that mixing time decreases strongly with superimposed swarm turbulence and becomes independent of bubble size. This is expected to have a major influence on chemical reactions. Especially slow parallel and consecutive reaction steps are promoted by poor mixing.

Additionally based on locally measured data, mass transfer coefficients of bubbles rising in counter-current flow and with superimposed swarm turbulence are calculated. With the presented method, concentration distributions are now accessible in bubble flows with high spatiotemporal resolution. This paves the way for validating numerical simulations and developing physically determined models.

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