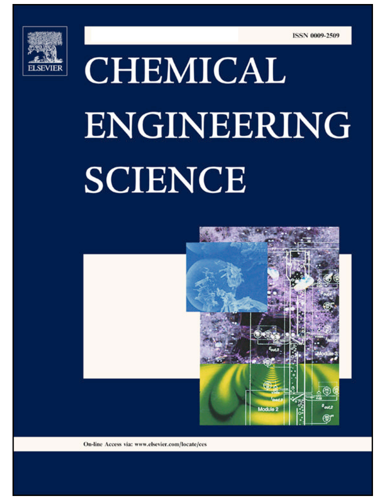

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An Improved Meso-Scale Flow Model of Gas-Liquid-Solid Fluidized Beds

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Abstract: Mechanism modeling is an important method to quantify the flow heterogeneous phenomena of gas-liquid-solid fluidization. In this study, an improved meso-scale flow model, based on the energy minimum multi-scale (EMMS) theory, is developed to predict the global flow parameters of gas-liquid-solid fluidized bed. The improved EMMS model introduces gas bubble and solid particle accelerations, which make the model is capable of accurately predicting both the nominal-steady and the unsteady hydrodynamics of gas-liquid-solid fluidization. Compared with the reported models, the predicted results of this improved EMMS model are closer to the experiment data. Furthermore, the predictions indicate that both gas bubble acceleration and solid particle acceleration have an influence on the flow behavior of gas-liquid-solid fluidized bed, such as gas bubble diameter and relative slip velocity, which seriously affect the momentum and mass transfer between phases. Meanwhile, the accelerations of gas bubble and solid particle are not always equal to 0 at the nominal-steady state. Furthermore, the acceleration behavior of the unsteady-state gives a reasonable explanation for gas bubble coalescence. However, the relative error between model predictions and experimental data increases with the superficial gas velocity and the solid particle inertia. Thus this improved EMMS model is suitable for flow system at low