A novel two-phase model for bubbling fluidized-bed CO-methanation reactor

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Abstract

Fluidized bed reactor is promising for CO methanation owing to its excellent heat transfer performance. The gas flow distribution between the bubble and emulsion phases and mass transfer are important for such a solid-catalyzed fast reaction in fluidized bed but these are described simplistically in most conventional models. In this work, a novel model contemplating the gas flow distribution influenced by circulation flow and the interphase mass transfer coefficient influenced by bubble size variation is proposed. The simulation results of the proposed model and the classic Kunii–Levenspiel model were compared with experimental data of fluidized bed CO methanation. It was shown that the results of the proposed model have better agreement with experimental data. To evaluate the roles of gas flow distribution and interphase mass transfer coefficient, sensitivity analysis was carried out. The results indicated that in the proposed model, the effect of gas flow distribution is more important.

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