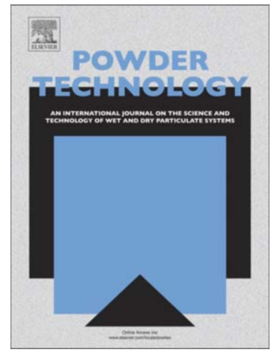

Numerical Investigation on the Solids flow Pattern in Bubbling Gas-Solid Fluidized Beds: Effects of Particle Size and Time Averaging

Maryam Askarishahi, Mohammad-Sadegh Salehi, Asghar Molaei Dehkordi

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Numerical Investigation on the Solids flow Pattern in Bubbling Gas-Solid Fluidized Beds: Effects of Particle Size and Time Averaging

Maryam Askarishahi, Mohammad-Sadegh Salehi, and Asghar Molaei Dehkordi*

Department of Chemical and Petroleum Engineering, Sharif University of Technology, P.O. Box 11155-9465, Tehran, Iran

Abstract

The effects of particle size on the solids flow pattern in gas-solid bubbling fluidized beds were investigated numerically using two-fluid model based on the kinetic theory of granular flow. In this regard, the set of governing equations was solved using finite volume method in two-dimensional Cartesian coordinate system. Glass bead particles with mean sizes of 880 μm, 500 μm, and 351 μm were fluidized by air flow at excess gas velocities of 0.2 m/s and 0.4 m/s. For particle diameters of 880 and 351 μm, the predicted characteristic times for solids dispersion were 0.14 s and 0.15 s, respectively, while characteristic times for solids diffusivity were 1.68 ms and 0.75 ms in the same order. Consequently, at identical time-sampling interval, for coarser particles, longer simulation time is required to achieve accurate solids flow pattern. Through examination of wide range of time-sampling interval from 0.1 ms to 40 ms, an optimum value of 10 ms with minimum simulation time was obtained for coarser particles. The predicted solids flow patterns at a simulation time of 7 s were in good agreement with the experimental data for both particle sizes of 880 and 351 μm. In addition, it was demonstrated that the effects of particle size on the solids flow pattern should be investigated alongside the variations in the excess gas velocity. In detail, predicted solids flow pattern underwent significant change with the excess gas velocity in the bed filled with a small particle size of 351 μm, but for larger particles no considerable change was seen. Moreover, the predicted gas bubble diameter and velocity were in agreement with experimental data.

***Keywords*:** Averaging Time; Computational Fluid Dynamic; Bubbling Fluidized Bed; Solids Mixing; Two-fluid Model.

*Corresponding author. Tel.: +98-21-6616-5401; fax: +98-21-6602-2853. *E-mail address*: amolaeid@sharif.edu