Hydrodynamics and heat transfer validation of a coarse grained particle method in a bubbling fluidized bed

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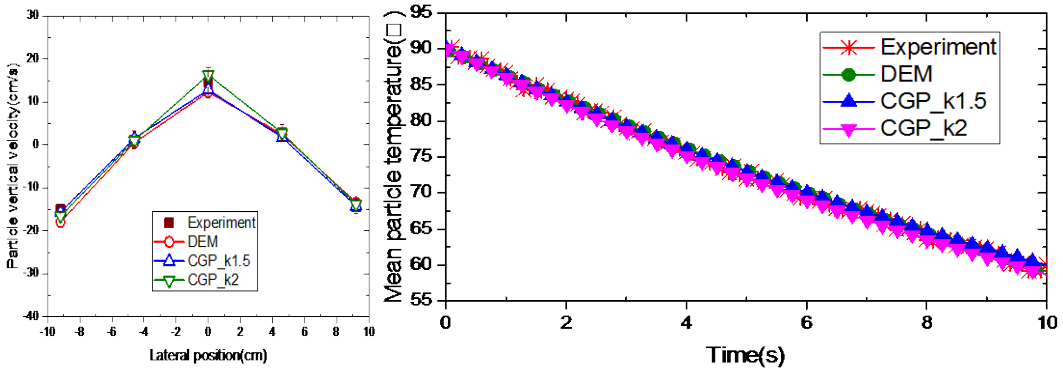
Abstract

The hydrodynamic and heat transfer in the bubbling fluidized beds have a comprehensive understanding by the coupling of traditional computational fluid dynamic and discrete element method (CFD-DEM). This approach may suffer from the cost of tracking huge number of particles with the increase of particles, and it is the fatal problem of the traditional CFD-DEM. In this paper, the coarse grained particle (CGP) method can fewer the number of particles to be tracked and the collisions occur between particles by lumping several real particles into a virtual parcel. The assumption is accepted that the real particles in a virtual parcel are made from same species and share identical physical properties including diameter, density and temperature. The governing equation in the coarse grained particle method is calculated using the same method as in traditional DEM. The simulation results of hydrodynamic and heat transfer in a bubbling fluidized bed with the coarse grained particle method compare well with the traditional CFD-DEM and experiment data. What is worth mentioning is that the particle velocity calculated with the CGP method agrees well with the experiment data and CFD-DEM. The simulation results show that it is reliable for the application of CGP method in large scale gas-solid fluidized bed.



(a) (b)

Fig. 1. (a) Radial profile of solid vertical velocity simulated with different methods; (b) Evolution of mean particle temperature profile.