TRANSPORT PHENOMENA & FLULD MECHANICS

CFB中环核结构的模拟

欧阳洁[a,b]，李静海[b]，孙国刚[c]

[a] Department of Applied Mathematics, Northwestern Polytechnical University, Xi'an 710072, China;
[b] Institute of Process Engineering, Chinese Academy of Sciences, Beijing 100080, China
[c] Department of Chemical Engineering, University of Petroleum, Beijing 100083, China

收稿日期　修回日期　网络版发布日期　接受日期

摘要　In this paper, the stochastic particle-trajectory model is proposed for simulating the dynamic behavior of circulating fluidized bed (CFB). In our model, the motion of solid phase is obtained by calculating the individual particle trajectory while gas flow is obtained by solving the Navier-Stokes Equation including two-phase interaction.For the calculation of solid phase, the motion of each particle is decomposed into a collision process and a suspension process. In suspension process, the less important and/or unclear forces are described as a random force considering gravity, drag force and pressure gradient. As a result, the proposed model gives some numerical simulations of CFB.It indicates that the stochastic particle-trajectory model can be used to simulate qualitatively the annulus-core structure of CFB and the influences of stochastic factors cannot be ignored. In a CFB, the coupling of stochastic factors between two phases makes the radial voidage decreased. Moreover, the upward motion of particles is mitigated by both stochastic factors and turbulence between two phases.

关键词　simulation　two-phase flow　particle-trajectory model　fluidization　random force

分类号

DOI:

The Simulations of Annulus-Core Structure in CFB

OUYANG Jie[a,b], LI Jinghai[b], SUN Guogang[c]

[a] Department of Applied Mathematics, Northwestern Polytechnical University, Xi'an 710072,
China;
[b] Institute of Process Engineering, Chinese Academy of Sciences, Beijing 100080,
China
[c] Department of Chemical Engineering, University of Petroleum, Beijing 100083, China

Abstract In this paper, the stochastic particle-trajectory model is proposed for simulating the dynamic behavior of circulating fluidized bed (CFB). In our model, the motion of solid phase is obtained by calculating the individual particle trajectory while gas flow is obtained by solving the Navier-Stokes Equation including two-phase interaction.For the calculation of solid phase, the motion of each particle is decomposed into a collision process and a suspension process. In suspension process, the less important and/or unclear forces are described as a random force considering gravity, drag force and pressure gradient. As a result, the proposed model gives some numerical simulations of CFB.It indicates that the stochastic particle-trajectory model can be used to simulate qualitatively the annulus-core structure of CFB and the influences of stochastic factors cannot be ignored. In a CFB, the coupling of stochastic factors between two phases makes the radial voidage decreased. Moreover, the upward motion of particles is mitigated by both stochastic factors and turbulence between two phases.

Key words simulation; two-phase flow; particle-trajectory model; fluidization; random force

通讯作者：
欧阳洁 gengxg@nwpu.edu.cn
作者个人主页：欧阳洁[a;b]，李静海[b]，孙国刚[c]