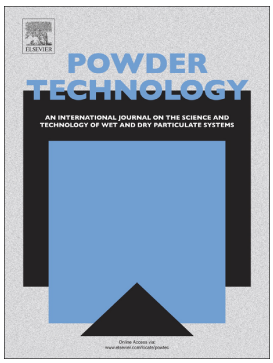

SIPHPM simulation and analysis of cubic particle mixing patterns and axial dispersion mechanisms in a three-dimensional cylinder

Nan Gui, Xingtuan Yang, Jiyuan Tu, Shengyao Jiang

PII: S0032-5910(18)30316-4
DOI: doi:10.1016/j.powtec.2018.04.036
Reference: PTEC 13337

To appear in: *Powder Technology*

Received date: 25 January 2018
Revised date: 19 March 2018
Accepted date: 16 April 2018

Please cite this article as: Nan Gui, Xingtuan Yang, Jiyuan Tu, Shengyao Jiang , SIPHPM simulation and analysis of cubic particle mixing patterns and axial dispersion mechanisms in a three-dimensional cylinder. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Ptec(2018), doi:10.1016/j.powtec.2018.04.036

SIPHPM simulation and analysis of cubic particle mixing patterns and axial dispersion mechanisms in a three-dimensional cylinder

Nan Gui[a,*], Xingtuan Yang[a], Jiyuan Tu[a,b], Shengyao Jiang[a]

[a] *Institute of Nuclear and New Energy Technology, Collaborative Innovation Center of Advanced Nuclear Energy Technology, Key Laboratory of Advanced Reactor Engineering and Safety of Ministry of Education, Tsinghua University, Beijing, 100084, People's Republic of China*

[b] *School of Engineering, RMIT University, Melbourne, VIC 3083, Australia*

Abstract

The mixing characteristics of cubic particles in a cylinder mixer are analyzed by the SIPHPM simulation in comparison with spherical particles. The assembly of cubic and spherical particles of uniform size is pre-divided into two parts in the axial, circumferential or radial directions respectively. Then they are mixed when the cylinder is rotated at different rotational speeds of Ω_d = 15 - 60 rpm. The mixing degree is evaluated by either the Lacey mixing index or the mixing information entropy. A normalized mixing entropy is proposed here to compare the absolute degree of mixing with non-equivalent particle numbers. It is found that, for cubes, the radial mixing efficiency is higher than the circumferential, and the radial and circumferential mixing degrees are both larger than the axial. Compared with spheres, cubic shape may enhance the circumferential mixing whereas reduce the axial mixing levels at high rotating speeds. However, at low rotating speed, cubic shape always reduces the degree of mixing of all the three patterns. Moreover, the axial dispersion characteristics are also explored by the probability density functions and the axial paths. The spatial and temporal diffusion coefficients of concentration and kinetic energies are illustrated and used to explain the axial dispersion mechanism in analogy with diffusion equation.

*Author for Correspondence: Nan Gui, Tel: +86 010 801 940 12 - 859; Email: guinan@mail.tsinghua.edu.cn