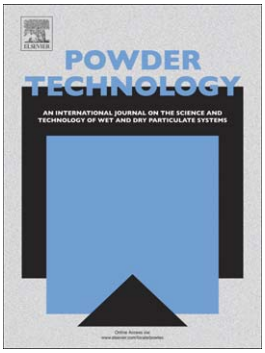

DEM simulation of wet granular-fluid flows in spouted beds: Numerical studies and experimental verifications

Huang Zhang, Shuiqing Li

PII: S0032-5910(17)30380-7
DOI: doi:10.1016/j.powtec.2017.05.009
Reference: PTEC 12535

To appear in: *Powder Technology*

Received date: 30 December 2016
Revised date: 18 April 2017
Accepted date: 5 May 2017

Please cite this article as: Huang Zhang, Shuiqing Li, DEM simulation of wet granular-fluid flows in spouted beds: Numerical studies and experimental verifications, *Powder Technology* (2017), doi:10.1016/j.powtec.2017.05.009

DEM simulation of wet granular-fluid flows in spouted beds: numerical studies and experimental verifications

Huang Zhang, Shuiqing Li*
Key Laboratory for the Thermal Science and Power Engineering of Ministry of Education,
Department of Thermal Engineering, Tsinghua University, Beijing 100084, China.
Corresponding Author*: lishuiqing@tsinghua.edu.cn

Abstract: Discrete Element Model (DEM), embedded into computational fluid dynamics (CFD), is developed to simulate the behaviors of wet granular-fluid flows in a thin spouted bed possessing two-dimensional characteristics. A cohesive contact model in presence of pendular liquid (polydimethylsiloxane oil) bridges between particles is improved on the basis of lubricated sliding friction and restitution coefficient of the wet grains. Special algorithm and array structure are designed to search the neighbors of wet grains. Then, the comparison of frequency, granular patterns, connecting networks, particle velocity profiles and spout geometry between the DEM simulations and our previous experiments are performed. The DEM simulation results indicate that the minimum spouting velocity (U_{ms}) is almost the same for both wet and dry system, which agrees well with the prediction by a simplified formula. The voidages and gas velocities along the spout axis of wet granular system are found to be larger than those of dry one. It well explains the larger vertical particle velocities of wet grains over those of dry ones. Finally, the granular temperature distributions are discussed. High granular temperature occurs not only along the spout, but also at the fountain-annulus corner. Comparing granular temperature at different bed levels, we found that granular temperature of wet case is larger than that of dry one in most regions of spout and fountain, but it is nearly the same in annulus.

Key words: DEM, spouted bed, wet granular matter, liquid bridge