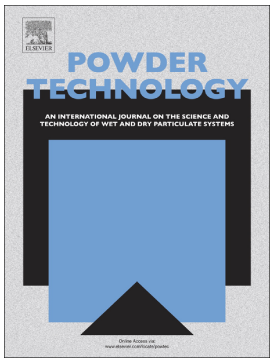

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PII: S0032-5910(18)30348-6
DOI: doi:10.1016/j.powtec.2018.04.067
Reference: PTEC 13368

To appear in: *Powder Technology*

Received date: 12 October 2017
Revised date: 13 February 2018
Accepted date: 23 April 2018

Please cite this article as: Jingsi Yang, Ronald W. Breault, Justin M. Weber, Steven L. Rowan , Determination of flow patterns by a novel image analysis technique in a rectangular spouted bed. The address for the corresponding author was captured as affiliation for all authors. Please check if appropriate. Ptec(2017), doi:10.1016/j.powtec.2018.04.067

Determination of flow patterns by a novel image analysis technique in a rectangular spouted bed

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ABSTRACT

The focus of this paper is to present a systematic and integrative image analysis technique for assessing the solids behavior in fluidized systems, particularly spouted beds. In doing so, an experimental study has been carried out to investigate the hydrodynamic characteristics of the gas-solid flow in a rectangular spouted bed (30.2 mm×101.6 mm) under three initial bed heights (0.0762 m, 0.102 m, and 0.127 m) for two different nozzle sizes (0.0096 m and 0.0127 m). To demonstrate this technique, six different flow patterns are identified through frame-by-frame examination of the images with one of these being asymmetrical spouting. The formation of a "curved gas path" and a "stagnant region" might cause the asymmetrical spouting. Additionally, an algorithm based on image analysis to determine the bed height is developed. The bed expansion ratio profiles show that the bed expansion ratio is a constant value of 1.4 at the onset of the external spouting, regardless of the initial bed heights and the nozzle sizes for the current configuration and operating conditions. The external spouting velocity and the internal spouting velocity can be determined from the bed expansion ratio curve and the bed pressure drop curve respectively. These two velocities are helpful in discriminating the different flow regimes. It is found that the external spouting velocity is more significantly influenced by the nozzle size compared to the internal

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