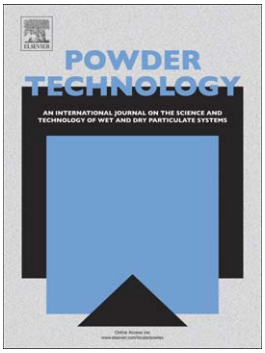

Fluidization of Titania Nanoparticle Agglomerates in a Bench-Scale Conical Vessel

Alireza Bahramian, John R. Grace

PII: S0032-5910(17)30029-3
DOI: doi:10.1016/j.powtec.2017.01.018
Reference: PTEC 12260

To appear in: *Powder Technology*

Received date: 2 May 2016
Revised date: 14 August 2016
Accepted date: 6 January 2017

Please cite this article as: Alireza Bahramian, John R. Grace, Fluidization of Titania Nanoparticle Agglomerates in a Bench-Scale Conical Vessel, *Powder Technology* (2017), doi:10.1016/j.powtec.2017.01.018

Fluidization of Titania Nanoparticle Agglomerates in a Bench-Scale Conical Vessel

Alireza Bahramian [a,*] *and John R. Grace* [b]

[a] Dept. of Chemical Engineering, Hamedan University of Technology, P.O. Box, 65155 Hamedan, Iran

[b] Dept. of Chemical and Biological Engineering, University of British Columbia, Vancouver, Canada V6T 1Z3

Abstract: TiO_2 nano-particles (NPs) with an average primary size of 30 nm were fluidized by nitrogen and air in a bench-scale conical vessel. The NPs tended to form simple-agglomerates with porous structures because of weak physical inter-particle forces. When the NPs were fluidized, they agglomerated further to form complex-agglomerates with coral-like structures, several hundred microns in size. A mechanism is proposed for the formation of these structures based on the experimental results. Agglomeration analysis by a laser technique and TEM imaging were used to measure the size of agglomerates. Bed collapse tests and bed expansion experiments were performed in the bed. The pressure-drop and bed height, as well as the gas velocity, were compared for NPs and micro-particles. The average size of agglomerates was estimated by both fractal analysis and based on the modified Richardson-Zaki equation. Model predictions are mostly in good agreement with the experimental data.

***Keywords*:** Nano-particle agglomerates, Coral-like TiO_2 structures, Conical bed, Dynamic and static imaging, Theoretical models.