

Accepted Manuscript

Investigation of cross-sectional gas-solid distributions in spouted beds using advanced non-invasive gamma-ray computed tomography (CT)

Thaar Al-Juwaya, Neven Ali, Muthanna Al-Dahhan

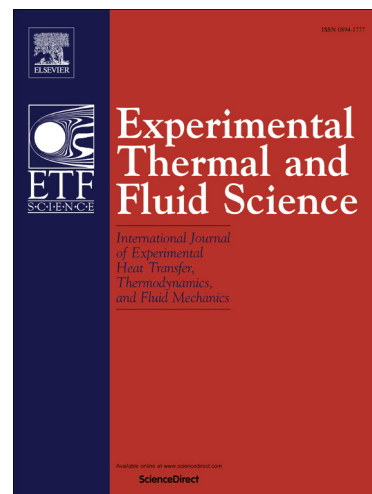
PII: S0894-1777(17)30091-2
DOI: <http://dx.doi.org/10.1016/j.expthermflusci.2017.03.029>
Reference: ETF 9059

To appear in: *Experimental Thermal and Fluid Science*

Received Date: 12 October 2016
Revised Date: 16 March 2017
Accepted Date: 26 March 2017

Please cite this article as: T. Al-Juwaya, N. Ali, M. Al-Dahhan, Investigation of cross-sectional gas-solid distributions in spouted beds using advanced non-invasive gamma-ray computed tomography (CT), *Experimental Thermal and Fluid Science* (2017), doi: <http://dx.doi.org/10.1016/j.expthermflusci.2017.03.029>

This is a PDF file of an unedited manuscript that has been accepted for publication. As a service to our customers we are providing this early version of the manuscript. The manuscript will undergo copyediting, typesetting, and review of the resulting proof before it is published in its final form. Please note that during the production process errors may be discovered which could affect the content, and all legal disclaimers that apply to the journal pertain.



Investigation of cross-sectional gas-solid distributions in spouted beds using advanced non-invasive gamma-ray computed tomography (CT)

Thaar Al-Juwaya^a, Neven Ali^a, Muthanna Al-Dahhan^{b*}

^aNuclear Engineering Department,

^{b*}Chemical and Biochemical Engineering Department,

Missouri University of Science and Technology (Missouri S&T), Rolla, MO 65409, United States

Abstract

The successful operation and safety of the Very-High-Temperature Nuclear Reactors (VHTR) extremely depend on the quality of the TRISO nuclear fuel coated particles. Hence, the fuel coating technology of TRISO particles, based on chemical vapour deposition (CVD) process, performed in gas-solid spouted beds, is of utmost importance. However, the deposition of the coating layers surrounding the kernel is a delicate process, and impacted by the hydrodynamics of spouted beds. Therefore, in this work, we have applied an advanced non-invasive gamma-ray computed tomography (CT) technique for the first time to investigate the hydrodynamics of spouted beds. In particular, we study the effect of particle density, particle size, bed size, and superficial gas velocity on the gas-solid cross-sectional distributions of spouted beds. The color distributions of the cross-sectional images clearly identified the three regions of spouted beds: the spout, the annulus, and the fountain regions. Interesting results and findings are presented, discussed and analyzed in the article. For example, the results demonstrated that the summation that operating spouted beds at stable spouting state would lead to achieving uniform coating layers of the particles in the TRISO fuel coating process is not adequate. Further, it has been found that increasing the superficial gas velocity much higher above the minimum spouting velocity increases the gas holdup in the annulus above the gas holdup value at the loss-packed bed state, contrary to common assumptions presented in the literature. This study represents an original experimental investigation required both for advancing the understanding of TRISO particles spouted bed and providing benchmark data to validate computational fluid dynamics (CFD).

*Corresponding author:

Tel.: +1 573 341 7518; fax: +1 573 341 4377.

E-mail addresses: aldahhanm@mst.edu

Keywords Spouted beds, TRISO, Gamma ray computed tomography (CT), Cross sectional distribution Phase holdup

Download English Version:

<https://daneshyari.com/en/article/4992484>

Download Persian Version:

<https://daneshyari.com/article/4992484>

[Daneshyari.com](https://daneshyari.com)