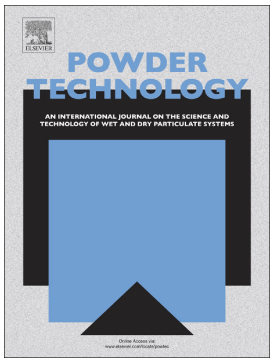

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Numerical investigation of the cluster property and flux distribution in three-dimensional full-loop circulating fluidized bed with multiple parallel cyclones

Shiliang Yang[a,b], Shuai Wang[a], Kun Luo[a,*], Jianren Fan, Jia Wei Chew[b,c,]**

[a]State Key Laboratory of Clean Energy Utilization, Energy Department, Zhejiang University, Hangzhou 310027, P.R. China

[b]School of Chemical and Biomedical Engineering, Nanyang Technological University, Singapore 637459, Singapore

[c]Singapore Membrane Technology Center, Nanyang Environment and Water Research Institute, Nanyang Technological University, Singapore 637141, Singapore

[*]Author for correspondence: Fax: +86-0571-87953687; E-mail: zjulk@zju.edu.cn

[**]Author for correspondence: Fax: +65-6316-8916; E-mail: JChew@ntu.edu.sg

Abstract

Circulating fluidized beds have been widely utilized in many industrial applications due to their excellent heat and mass transfer performance. By means of computational fluid dynamics coupled with discrete element method, numerical simulation of the three-dimensional full-loop circulating fluidized bed with six parallel cyclones is conducted, with a focus on the cluster behavior, flux and granular temperature. The results agree with past studies that the particle clusters dynamically evolve with time and space, and the upward-rising and downward-falling clusters tend to be in respectively the central core and near-wall regions. Notably, the frequency distribution of the cluster volume is shown to be approximately normal; and the aspect ratios of the clusters are consistently larger than one, and tend to increase before decreasing with riser height. Furthermore, the slip velocity is the most significant in the cross-sectional center of the riser and upper part of the cyclone. Finally, the granular temperatures are greatest at the cross-sectional center of the riser inlet, at the top of four of the six cyclones, and also at the middle