Clustering in Gas-Fluidized Riser Flows of Flexible Fibers

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Abstract

Clustering of flexible fibers in riser flows is investigated using a hybrid approach of Discrete Element Method and Computational Fluid Dynamics. Unlike spherical particles, the flexible fibers possess elongated shape, undergo significant deformation, and dissipate kinetic energies through rapid fiber deformation. The present studies show that these distinct features have significant impacts on the cluster characteristics of the fibers. An increased fiber aspect ratio leads to an increase in number and size of agglomerates, while it causes a reduction in heterogeneity of solids distribution due to the more dilute clusters with reduced packing densities. As the fibers become more flexible, the heterogeneity increases, and denser clusters are obtained. More significant effects of the fiber flexibility on the clustering are observed for the fibers with larger aspect ratios. The increased energy dissipation through the rapid fiber deformation enhances the clustering by augmenting the number and size of the agglomerates.

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