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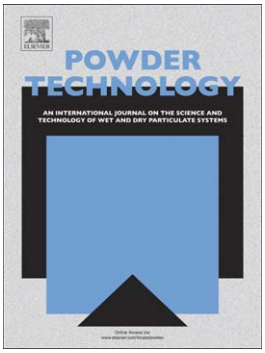

CFD simulation of the preheater cyclone of a cement plant and the optimization of its performance using a combination of the design of experiments and multi-gene genetic programming

Elham Kashani, Ali Mohebbi, Mahdi Ghaedi Heidari

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CFD simulation of the preheater cyclone of a cement plant and the optimization of its performance using a combination of the design of experiments and multi-gene genetic programming

Elham Kashani[1], Ali Mohebbi[1,*], Mahdi Ghaedi Heidari[2]

1. Department of Chemical Engineering, Faculty of Engineering, Shahid Bahonar University of Kerman, Kerman, Iran

2. Kerman cement plant, Kerman, Iran

Abstract

Hurriclon cyclone is a specially designed preheater cyclone with two outlet connector pipes of cleaned gas in the cement industry. In Kerman cement plant, Iran, the initial structure of this cyclone was changed. This caused a decrease in the cyclone efficiency. In this study, to optimize the changed cyclone performance, one of the twin cyclones in the first-stage of the preheater tower, which had the most significant effect on particle separation from gas was simulated and validated by computational fluid dynamics. Using the design of experiment based on the simulation results, the effects of three dimensions (vortex-finder length, cylinder height, and cone tip diameter) were investigated on cyclone performance. The turbulent gas flow inside the cyclone was modelled using the Reynolds stress model due to the swirling flow inside the cyclones. The discrete phase model was used to calculate the trajectory of particles. It was observed that because of high gas inlet velocity and particle density as well as the geometry of the preheater cyclone, particles larger than the critical diameter continue spinning in the cyclone.

[*] Corresponding author: Tel & Fax: +983432118298
E-mail addresses: amohebbi2002@yahoo.com, amohebbi@uk.ac.ir

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