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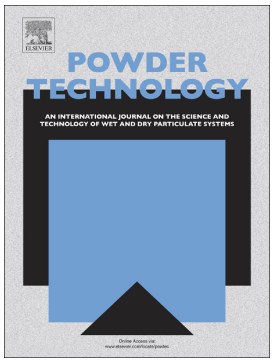

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Measurement of the local material depth in a directly-heated pilot rotary kiln based on temperature fields

Wei-Ning Wu[1], Xiao-Yan Liu[1,2,*], Zhou Hu[1], Fabian Herz[3], Eckehard Specht[4]

[1]College of Electrical and Information Engineering, Hunan University, 410082 Changsha, China

[2]Hunan Key Laboratory of Intelligent Robot Technology in Electronic Manufacturing, Changsha 410082, China

[3]Department of Applied Biosciences and Process Engineering, Anhalt University of Applied Sciences, 06366 Köthen, Germany

[4]Institute of Fluid Dynamics and Thermodynamics, OvG-University Magdeburg, 39106 Magdeburg, Germany

* Corresponding author: xiaoyan.liu@hnu.edu.cn, 0086-731-88822224

Abstract

The heat and mass transfer processes in rotary kilns are greatly influenced by the depth of the material. A method is proposed for automatic measurement of the local material depth in a directly-heated pilot rotary kiln, based on temperature fields in the kiln cross section. By analyzing the motion behavior of the material and the periodic pattern of the temperatures profile, the material region and the gas region are qualitatively identified. A statistical variable is then proposed to estimate the average temperature of the active layer of the material bed, with which the central angle covered by the thermocouples through the material bed can be determined and thus the material depth be estimated using geometrical relationship. The effectiveness of the proposed measuring method for bed depth is tested on a directly heated pilot rotary kiln and compared with results of manual measurement. It is found that the proposed method has good accuracy (maximal error 7%) as well as good stability for all the fourteen testing cases. Results of this work can be used conveniently in the experimental study of rotary kiln process, without introducing any additional hardware.

Keywords: Rotary kiln; Rotary drum; Granular material; Temperature measurement; Material depth

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