

Accepted Manuscript

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PII: S0032-5910(17)30492-8  
DOI: doi:[10.1016/j.powtec.2017.06.033](https://doi.org/10.1016/j.powtec.2017.06.033)  
Reference: PTEC 12609

To appear in: *Powder Technology*

Received date: 8 June 2016  
Revised date: 20 April 2017  
Accepted date: 14 June 2017



Please cite this article as: Wenhui Li, Li Zhang, Xiuhong Li, Shengqiang Yang, Fengfeng Wu, Theoretical and Simulation Analysis of Abrasive Particles in Centrifugal Barrel Finishing: Kinematics Mechanism and Distribution Characteristics, *Powder Technology* (2017), doi:[10.1016/j.powtec.2017.06.033](https://doi.org/10.1016/j.powtec.2017.06.033)

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## Theoretical and Simulation Analysis of Abrasive Particles in Centrifugal Barrel Finishing: Kinematics Mechanism and Distribution Characteristics<sup>1</sup>

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**Abstract:** Centrifugal barrel finishing processes, as a class of typical mass finishing methods, have been used to deburr and finish metallic components across a wide range of industries. For achieving excellent finishing effects and high efficiency, the determination of the process parameters, especially the transmission ratio, is necessary. Almost all the process parameters remain largely empirical owing to the motion uncertainty of the abrasive particles in the drum. The velocity and acceleration of arbitrary point in or on the drum were analyzed at different transmission ratios. Then, the kinematics mechanism and the distribution characteristics of the abrasive particles in the drum were analyzed to find the relationship between the transmission ratio and the motion status of the abrasive particles. By means of discrete element numerical simulation, the critical value of the transmission ratio was finally determined. The transmission ratio has a profound influence on abrasive particles' behavior for seeking the ideal motion status of the abrasive particles that can ensure the normal running of finishing processes.

**Keywords:** Centrifugal barrel finishing, Abrasive particles, Kinematics characteristics, Discrete element method

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