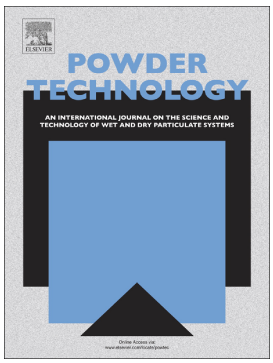

Visualization of flow conditions inside spiral jet mills with different nozzle numbers – Analysis of unloaded and loaded mills and correlation with grinding performance

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PII:	S0032-5910(18)30809-X
DOI:	doi:10.1016/j.powtec.2018.09.078
Reference:	PTEC 13752
To appear in:	*Powder Technology*
Received date:	14 December 2017
Revised date:	20 September 2018
Accepted date:	26 September 2018

Please cite this article as: Bartholomäus Luczak, Rolf Müller, Christian Kessel, Mathias Ulbricht, Heyko Jürgen Schultz , Visualization of flow conditions inside spiral jet mills with different nozzle numbers – Analysis of unloaded and loaded mills and correlation with grinding performance. Ptec (2018), doi:10.1016/j.powtec.2018.09.078

Visualization of flow conditions inside spiral jet mills with different nozzle numbers – Analysis of unloaded and loaded mills and correlation with grinding performance

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Abstract

Plenty of operational and geometric parameters have effects on spiral jet milling. Changes in the parameters cause distinctions in the flow conditions inside the mill and thereby also lead to consequences regarding the milled product. A new type of experimental spiral jet mill apparatus with almost entire optical accessibility enables a very convenient variation of the operational and geometric parameters as well as the determination of the flow conditions inside the spiral jet mill via non-invasive optical methods. Particle Image Velocimetry (PIV) measurements with diethylhexyl sebacat (DEHS) tracer droplets as well as solid barium sulphate micro particles were carried out to investigate the flow conditions inside the spiral jet mill. The differences between the net milling gas velocity fields and the velocity fields of loaded spiral jet mills were exposed. With the mill being loaded, the comminution zone decreases in the horizontal direction as well as decreases and deflects in the vertical direction. Besides, the analysis of the velocity fields inside the mill apparatus showed that decreasing milling nozzle numbers lead to increasing velocities inside the spiral jet mill, even if the mass flow rate of the gas supply is kept constant and the nozzle jet velocity is limited to sonic velocity at choked flow. With decreasing milling nozzle numbers, broader comminution zones and increasing lengths of the milling jets were investigated. As a consequence, a better grinding efficiency was expected and also confirmed with decreasing milling nozzle number by grinding experiments, as the new type of experimental apparatus was constructed in a fully operative way concerning the grinding ability.

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