Performance evaluation of polygonal and cylindrical ball mills using discrete element method

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Abstract

Ball mills are commonly used in chemical and mineral processing industries for particle size reduction. In mineral processing, cylindrical drums with wear resistant materials are used various operation scales. Polygon shaped mills have found application by artisanal and small-scale miners (ASM) due technological and economic reasons. Evaluating this kind of mills is key in improving or replacing them based on technological data. A modest improvement in grinding efficiency and mill durability can lead to significant economic and environmental benefits. In this study, the performance of polygonal shaped mills was evaluated and compared with cylindrical profiles considering power draw, collision energy dissipation, relative wear and operational stability. Discrete element method (DEM) was used to carry out simulations to describe mechanical behavior of grinding media and the interaction with the mill walls. Polygonal shaped mills without lifters promoted more interparticle interaction with limited centrifuging of particle even at higher speeds compared to cylindrical mills without lifters. Installation of lifters in polygon increased inter-particle collisions and reduce power draw and relative wear. Cylindrical mill with lifters had high interparticle collisions similar to polygonal profile with much lower cumulative relative wear and high operational stability.

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`M. N. Kyalo- Mill profile performance evaluation using DEM.docx` available at https://authorea.com/users/817062/articles/1217628-performance-evaluation-of-polygonal-and-cylindrical-ball-mills-using-discrete-element-method