A Holistic Approach to Designing and Assessing the Performance of AG/SAG and Ball Mill Discharge Systems

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Abstract

Tumbling mills have been a core technology in the comminution stage of ore processing for the mining industry for over a century. The efficiency of any comminution device depends on how effectively it converts input energy into particle breakage and how quickly the product sized particles are removed from the system.

Transport of the particles through the charge and their discharge from the mill are among the key factors that determine both energy usage and capacity. To exploit the cost advantage of economy of scale, the processing of low-grade ores has seen the design of larger tumbling mills to meet the required throughput demand. As the tumbling mills become larger, the limitations in most discharge designs become more pronounced.

To address these shortcomings in the discharge capacity, many studies have been commissioned. Studies have shown that conventional pulp lifters experience significant flow-back and carry-over, limiting overall discharge performance. To address the issues that were observed in AG/SAG and Ball mills, different discharge grate designs were developed and tested.

Some of the designs focused on spiral pulp lifers with apertures positioned in the areas that results in minimal flowback. The development of the dual-chamber pulp lifter, followed by the TPL and EEPL designs, resulted in significant improvements in discharge capacity for tumbling mills. This paper will discuss the evolution of discharge designs and their influence on the performance of tumbling mills.

Case studies showing how improved designs have led to significant energy savings as well as increased throughputs will be presented. Recommendations for a holistic approach to designing and assessing tumbling mill performance will be provided.