Milling circuit optimization study for Kroondal 1 platinum concentrator

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Kroondal 1 platinum concentrator, operated by MINOPEX SA, treats UG2 ore in a flow sheet comprising comminution, DMS, and flotation. The comminution circuit comprises crushing and milling. The milling circuit consists of two primary mills and one secondary mill. The primary mills are lined with composite rubber liners while the secondary mill is lined with rubber liners. Multotec was engaged by MINOPEX in order to provide support aimed at improving the performance of the milling circuit.

The work described here was carried out in the fourth quarter of 2014 and first quarter of 2015 around the milling circuit with the objectives of minimizing scats generation, increasing fineness of the product to meet the target grind, and also to increase the throughput. The scope of work included determining the optimum lifter profile that would provide the necessary mode of breakage as well as the optimum top ball size required to break the top feed size, and the energy required to achieve the target grind for the current F80.

The lifters installed at the time, and operating conditions were analysed to determine what impacts they might have on the performance of the mill. This led to liner design optimization to effect the improvements.

Taking into consideration the ore characteristics, operating conditions and desiring to increase cascading and at the same time retaining some charge cataracting, as well as a balance between achieving objectives without adversely affecting liner life, changes to the lifter profile aimed at providing required charge behaviour were recommended for both the primary and secondary mills.

No changes were recommended regarding the top ball sizes.

Based on primary mill power available and operating conditions, it was observed that there were limitations on what the primary mill could achieve. The secondary mill was observed to draw more power than was necessary. This power was being lost without achieving the required milling performance. It was recommended that power input for the secondary mill be reduced from 4410 kW to 3630 kW. This reduction would not have an adverse effect on the grind.

Other options to improve the grind included consideration of mill filling and percentage solids. These required further laboratory grinding tests for verification.

An evaluation of the impact of the changes will be undertaken, and consultation is ongoing.

INTRODUCTION

Background

Until 2010/11, Kroondal mine operated their primary mills at the KP1 concentrator as rod mills running at 68% of critical speed. The rod mills were subsequently converted into ball mills. At the end of April 2013, the gearbox of primary ball mill no. 1 was changed to run at 78.4% of critical speed with the idea of running at higher tonnages while delivering the same grind. However, the objective of increasing the tonnage was not achieved. Instead, throughput on primary mill no. 1 decreased and more scats were generated. Following this observation, the mine decreased the speed of the mill to the previous 68% of critical.

The mine carried out a sampling camping at the end of August 2013, by which time the mill speed had already been changed back to 68%. The mine carried out another sampling campaign from the end of March to early April 2014. The mill was still generating scats, although less than at 78% critical speed.

The original milling circuit design for the KP1 concentrator was based on the following:

- Primary milling to 30% passing 75 µm
- Secondary milling to between 67 and 72% passing 75 µm, with natural fines grits.

Comminution Circuit Description

The KP1 plant consists of two primary ball mills converted from rod mills, which are running in parallel, and a secondary ball mill. Figure 1 shows the primary milling circuit, and Figure 2 the secondary milling circuit, with the sampling points indicated.

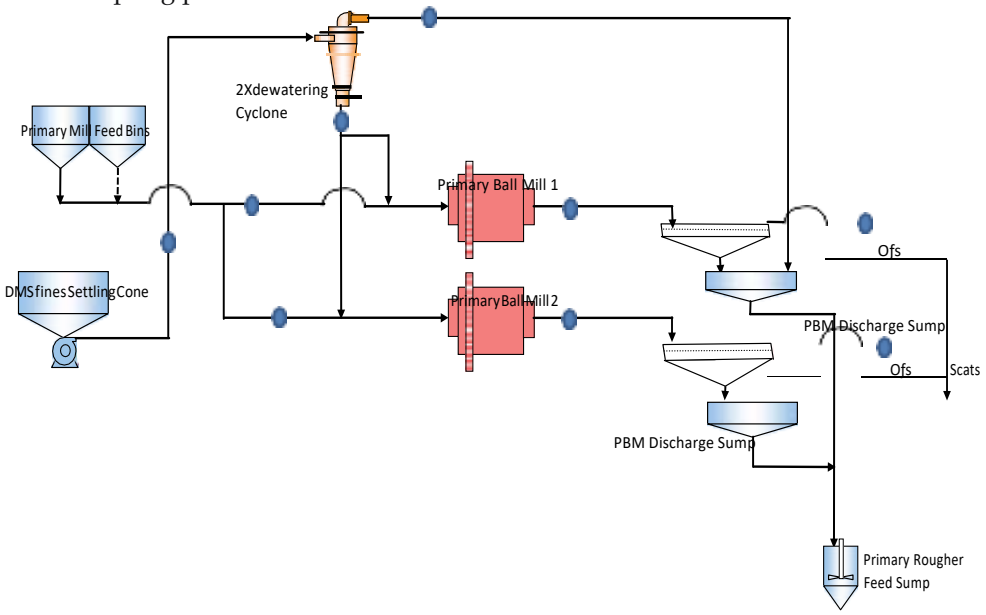

Figure 1. Simplified flow sheet of the primary milling circuit indicating sampling points (blue spots).

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