Geometallurgical characterisation of Merensky Reef and UG2 at the Marikana Mine, Bushveld Complex, South Africa

T.Dzvinamurungua; K.S.Viljoena; M.W.Knopera; A.Mulaba-Bafubiandi

Abstract

The influence of mineralogy on the milling performance and the flotation-based recovery of Au, the platinum group elements (PGE), Co, Cr, Cu, Ni and S was investigated for three samples of the Merensky Reef (BK, RPM and WP facies types) and one sample of the UG2 at the Marikana mine, using a mineral liberation analyser (MLA). The samples differ in their milling behaviour in that a range of milling times are required in order to produce a grind of 60% passing 75 μm. This is primarily controlled by the abundance of plagioclase, orthopyroxene and chromite.

The size distribution of the base metal sulfides (BMS; pyrrhotite, pentlandite and chalcopyrite) is similar for the three samples of Merensky Reef, and is significantly coarser than for BMS in the sample of the UG2. Upon milling to 60% passing 75 μm, the best BMS liberation is achieved for the BK facies type of Merensky Reef, relative to RPM and WP. The degree of BMS liberation in the sample of UG2 is lower than that for samples of the Merensky Reef.

Cumulative mass pull during flotation is higher for the sample of the WP facies of Merensky Reef than for the rest of the samples examined. This is due to the higher abundance of orthopyroxene in this sample, which is known to be naturally floating, and which reports to concentrate.

A high flotation-based recovery of PGE, Cu and S is observed for all four samples, with the highest recovery associated with the sample of the BK facies type of Merensky Reef. Ni recoveries are generally poor, suggesting that Ni is associated with gangue minerals, in addition to that in pentlandite.

Of the three facies types of Merensky Reef examined, the overall characteristics of the BK facies type i.e. a high PGE grade, low abundance of orthopyroxene, a high abundance of BMS, and a higher degree of liberation of the BMS on milling of the ore, represent the most favourable set of characteristics for the efficient recovery of PGE. It is therefore the best quality ore of the three samples of Merensky Reef examined.