CHARACTERISING DIFFERENT MODES OF PARTICLE BREAKAGE ON COARSE GANGUE REJECTION FOR AN OROGENIC GOLD ORE

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ABSTRACT

It is well recognised that the natural heterogeneity of an ore's mineralisation and amenability to coarse particle gangue rejection (CPGR) by fine crushing will influence its physical separation, i.e. preconcentration, potential. At the resource level, CPGR allows for a lower mine cut-off grade by achieving higher metal unit productivity in mineral processing by reducing the proportion of waste rock that is subjected to energy-intensive comminution and downstream beneficiation processes.

It is also important to recognize the influence that different crushing/breakage modes may have on barren material liberation patterns as, consequently, this may also enhance the economic viability of some projects. A poor understanding of the effect of crushing mode for CPGR as imparted by combined size and density-based separation processes can lead to shortcomings in both the strategic beneficiation approach and profitable exploitation of the resource. In this research, fine crushing breakage modes induced by cone, SELFRAG Lab (SELFRAG), high pressure grinding roll (HPGR) and vertical shaft impactor (VSI) crushing mechanisms have been investigated for CPGR in the "pumpable" ≤2.00 mm size range.

In this paper a methodology is described to predict and rank preferential grade by size and density deportment responses. The responses are a function of a selected fine crushing mode and classification scheme. Classification schemes are examined for both size and density-based separation. Responses are characterised by parameters describing the propensity of an ore to preferentially concentrate metal into specific size or density fractions, during breakage. The methodology provides an indicator for measuring the extent of gangue and metal liberation for a free milling gold ore, taken from the Ballarat region in Western Australia. This methodology defines coarse particle mineral liberation as a measurable rock property that can be linked with fine crushing mode and downstream separation technique.