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Flotation of non-sulphide PGM ores - Optimization of flotation reagent suite and conditions

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ABSTRACT

The aim of this study is to improve the flotation of non-sulphide PGM ores from the Mimosa Mine in the Great Dyke of Zimbabwe by evaluating a variety of collector reagents that have not been tested on such material before and applying a full factorial experimental design to investigate the effects of the main primary collector, co-collector and depressant on PGM recovery and grade.

The mineralogical studies by XRD revealed that the non-sulphide PGM ore had substantial amounts of gangue material, comprising of 45% quartz, 21% chabazite and 33% of magnetite. The ICP-OES analysis showed that this particular non-sulphide PGM ore is a low-grade ore with an average 4E head assays of 2.37ppm.

In the preliminary flotation stage, three reagent suites made up of (i) a collector, (ii) a co-collector and (iii) a depressant i.e. (SIBX, DTP, M98B); (SIBX, C7133, M98B) and (SIBX, AM810, M98B) respectively were tested. It was observed that (SIBX, AM810, M98B) reagent suite gave the best performance with respect to both recovery and grade of the PGM concentrate from the ore. Attempts were made to optimize the dosage levels of the 3 reagents. The optimization studies revealed that 78.5% Pt and 69.3% Pd can be recovered at grades of 17.90g/t Pt and 9.44g/t Pd respectively. This represents a significant upgrade for the roughing stage from the 1.42g/t Pt and 0.85g/t Pd in the feed. These results were obtained at optimized dosages of 86g/t SIBX and 80g/t AM810, with depressant M98B at 50g/t.

The observations from the experiments indicated that recovery of PGEs was on the upward trend as the dosage of hydroxamate was increasing hence the effect of the hydroxamate co-collector was further tested at higher dosages while fixing SIBX at 100g/t. The experiments were carried out using 50g/t, 60g/t, 70g/t and 80g/t hydroxamate (AM810) with the depressant M98B at 50g/t. It was observed that the Pt recovery only increased slightly with increasing hydroxamate (AM810) dosage.