Analysis of the Mt Isa Copper Concentrate Preflotation Circuit using Advanced Diagnostic Techniques

K. Runge, S. Brito e Abreu, C. Evans[3], R. O'Donnell[4]

1. Separation Group Leader, University of Queensland, Sustainable Minerals Institute, Julius Kruttschnitt Mineral Research Centre, Brisbane, Qld 4068, Email: k.runge@uq.edu.au
2. Research Fellow, University of Queensland, Sustainable Minerals Institute, Julius Kruttschnitt Mineral Research Centre, Brisbane, Qld 4068, Email: s.britoeabreu@uq.edu.au
3. Senior Research Fellow, University of Queensland, Sustainable Minerals Institute, W.H. Bryan Mining and Geology Research Centre, Brisbane, Qld 4068, Email: c.evans@uq.edu.au
4. Senior Metallurgist, Mt Isa Mines, Mt Isa, Qld, 4825, Email: roxanne.odonnell@glencore.com.au

ABSTRACT

Keywords: talc, chalcopyrite, mineralogy, flotation modelling, surface chemistry

The Mt Isa Copper concentrator employs a preflotation stage to remove naturally-floating talc prior to copper flotation. JKMRC researchers in collaboration with the Mt Isa metallurgical team performed a diagnostic study of this circuit with the aim of developing strategies to improve talc recovery to the pre-float concentrate while minimising copper losses. This study included a circuit survey, with samples assayed, sized and their liberation analysed using the Mineral Liberation Analyser (MLA). Batch laboratory flotation tests of key circuit streams were performed to enable development of a JKSimFloat flotation model. The surfaces of particles from the concentrate and tailing streams were analysed using Time-of-Flight Secondary Ion Mass Spectrometry (ToF-SIMS) to compare statistically surface speciation of talc and chalcopyrite particles and determine the role of chemical speciation on flotation recovery.

The results of these various analyses indicated that talc recovery is incomplete in the circuit because talc, although liberated, is fine and floats very slowly. Copper recovered to the preflotation concentrate was primarily due to flotation (rather than entrainment) caused by residual collector in the process water attaching to chalcopyrite particle surfaces. Model simulations suggest that talc recovery could be improved by increasing preflotation roughing and cleaning capacity but multiple stages of cleaning would be required to minimise copper recovery. Selective talc aggregation and process water modification were suggested as potential methods of improving talc recovery and talc/chalcopyrite selectivity.

This paper describes the experimental work performed and the results of sequentially applying analytical methods to diagnose circuit behaviour and demonstrates the power of combining mineralogical, modelling and surface chemical analysis to comprehensively study a flotation circuit. In this case, it enabled the particle recovery mechanisms to be determined and provided a diverse list of strategies for circuit improvement, many of which would not have been identified via a conventional circuit audit.