THE SEPARATION OF PYRITE AND ARSENOPYRITE BY FLOTATION

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Project details

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<th>Topic(s):</th>
<th>Funding scheme:</th>
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<th>Total cost:</th>
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Objective

The aim of the research programme is to investigate the potential of flotation for the separation of arsenopyrite and pyrite minerals. The efficient separation of pyrite and arsenopyrite by a cheap process such as flotation has long been recognized as a desirable technological goal for ores containing both minerals. A series of novel collectors, based on a different chemistry from conventional xanthates and similar surfactants, has been developed, which might lead to the separation of sulphide minerals with better selectivity and under less stringent control. These collectors are either cationic or nonionic and were shown to have remarkable selectivity for chalcopyrite. The primary amine derivative, designated F1, was also found to float pyrite in a narrow region between pH 10 and 11.5. The flotation was simple, requiring only F1, a frother and sodium hydroxide. This system offers significant advantages over conventional xanthate flotation where the required sulphuric acid constitutes a large cost and the corrosive environment leads to increased maintenance. The results obtained with 2 other, nonionic, collectors were not as good as those for F1.

Further work needs to be carried out on the use of F1 as this offers the potential of saving reagent costs. At present F1 collects sphalerite as well as pyrite but several sphalerite depressants such as zinc sulphate, ethylenediaminetetraacetate and quebracho should be investigated.

The implementation of the research programme will include the following phases.

Phase 1 will involve basic flotation studies on arsenopyrite and pyrite pure mineral samples. The effect of new chelating collector reagents and combinations of the new with conventional reagents (ie xanthate) on pyrite minerals floatability will be examined. The effects of pH, concentrations, temperature and oxygen (Eh) for mineral and reagent combinations will be studied. During this phase of the project the effect of depressants such as sodium sulphide, potassium manganese oxide, potassium chromium oxide, and sodium chloride oxide on arsenopyrite and pyrite recovery will be defined. Due to restricted availability of pure mineral samples most of the basic work will be carried out at small scale using Hallimond tube flotation tests. Absorption isotherm measurements and electrochemical techniques will be employed as experimental tools. First layer surface analysis (Auger electron spectroscopy and X-ray photoelectron spectroscopy may be employed on selected flotation fraction in order to elucidate the nature and composition of the reaction products formed on the surface of the minerals.

Phase 2 will involve laboratory cell flotation tests on composite pure mineral samples to examine their selective separation in the presence of optimum collector and modifying reagent combinations as defined in the previous stage.

Phase 3 will involve applied laboratory cell flotation tests on ore from the Salsigne mine in France to apply the basic research findings to a real ore. Note that this part of the work is dependent on the agreement of the Salsigne company to the use of their ore and the provision of sufficient mineralogical information about the ore by the company to enable flotation testing to be carried out in a technically correct manner.
Phase 4 will involve the applied work. This will include laboratory cell flotation tests on Olympias and Stratoni pyrite concentrates to investigate the selective separation of a clean pyrite and an arsenic rich product using conventional flotation reagents (ie xanthate) and appropriate modifiers. Operating conditions including particle size and retention time at the different flotation stages will be defined. Mineralogical analysis (optical microscopy, X-ray diffraction(XRD) and electron microprobe analysis) will be carried out to investigate mineral composition and liberation in the feed material. Arsenic and associated gold distribution in the different flotation fractions will be studied.

In phase 5, basic research findings, on the use of the new chelating type reagents obtained during the work outlined in stages 1 and 2 above will be applied to the treatment of the Greek concentrates in order to improve the selectivity of separation using the same methodology as described in stage 4.

Phase 6 involves evaluation of the teswork results. The experimental data obtained during the previous stages of the project will be assessed to define the optimum conditions for selective arsenopyrite pyrite separation and potentially develop a flotation process flow sheet for the treatment of the Olympias and Stratoni concentrates.

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