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New reagent for fine gold recovery during copper ores processing

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ABSTRACT

During flotation treatment of copper ores, more than 30% of the metallurgical losses could be attributed to the non-recoverable fine dispersed gold. Gold particles are most commonly met in region 1-3 m. Due to their high surface hydrophobicity they are often lost in the clarified water of the thickeners. Closed loop water use does not lead to elimination of these losses. On the basis of the flotation behavior of the fine gold particles, a new flotation collector has been synthesized securing their efficient recovery in the copper concentrate. The reagent reduces gold losses in the clarified water from the thickeners and in the filter waters from the vacuum filters. The reagent is oil-based and is naturally introduced in the grinding cycle. The behavior of its functional groups offer the possibility of sticking the gold particles onto chalcopyrite grains and thus their collective recovery as a final concentrate. The new reagent is particularly suitable when a part of the gold is dispersed as emulsion within pyrite or quartz.

***Keywords** : Ditan, Copper, Gold, Supplementary collector.*

INTRODUCTION

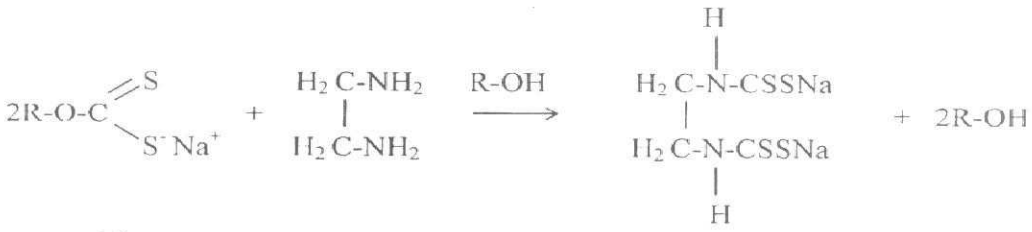
The practice of several collectors in ores flotation is based on two main factors :

1. The mineral surfaces are very heterogeneous
2. Necessity to recover two or more minerals with different flotation properties in bulk concentrate.

In our copper sulfide ores main part of the gold is very finely disseminated in copper minerals, pyrite and silica. The gold is lost in tailings as coatings on grains and in locked forms in rock and pyrite grains. Only 30 to 50 % of gold reports to copper concentrates and is recovered during metallurgical processing.

INVESTIGATION

The main purpose of new reagent development was increasing the flotation recovery of the fine gold in copper concentrate. As per our requirement the new collector should contain S and N. It was proposed by using xanthate, alcohol and ethylene diamine in definite proportion. The reagent seems to be ditan.



The reagent was used as a supplementary collector during flotation of copper sulfide ore. The ore contains : Cu-0.38 %; S-2.0 %; Au-0.06 g/t. The main copper sulfide minerals are chalcopyrite, bornite, covellite, chalcocite. There are varying amounts of pyrite, galena, molibdenite and magnetite. The gold is very finely disseminated in copper minerals, pyrite and silica. The ore sample was ground in laboratory ball mill in 1050g batch and was floated in 3 litre derives flotation cell with rotational speed of 1500 min^{-1}.

RESULTS AND DISCUSION

The flotation tests were carried out in open circuit as per the flowsheets shown in Figs. 1 and 2. Flowsheet shown on Fig. 1 was used for investigation influence of the dosage of supplementary collector on gold and copper recovery in bulk concentrate. The results are shown in Fig. 3. As we can see from Fig. 3 that gold shows an increase in recovery in the range of low concentration of dictan. When the concentration of ditan is higher the recovery of the gold and copper are parallel. By scavenger flotation (Fig. 2) the recoveries of the copper and the gold increases to 85.5% and 74.15 % respectively. The use of the convenient frother, permits without scavenger flotation the recovery of the gold 76.40 %. Particularly the influence of the ditan is very positive in presence of high concentration of the CaO in flotation pulp (Fig. 4).

The Analysis of the results (Fig. 4) show that the use of ditan like supplementary collector to go decreasing the negative influence of the high concentration CaO on the gold recovery in copper sulfide ores flotation.

For investigating the mechanism of the actions of ditan in flotation of gold, 100g sample from the concentrate was washed using ether. The solid phase in ether was analysed. The concentration of gold was found to be 26 g/t (while only 3, 4 g/t gold in concentrate). The improvement in gold recovery is probably due to improvement in the recovery of fine particles of gold. The fine particles of gold coat the copper sulphide mineral grains and afford to the froth collectively.

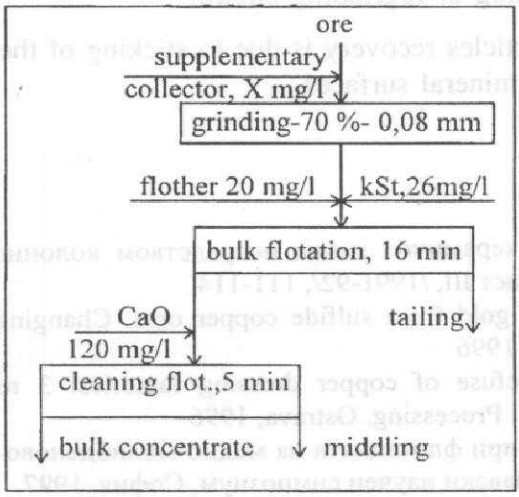


Fig. 1 : Flowsheet of the tests in open circuit collector determining

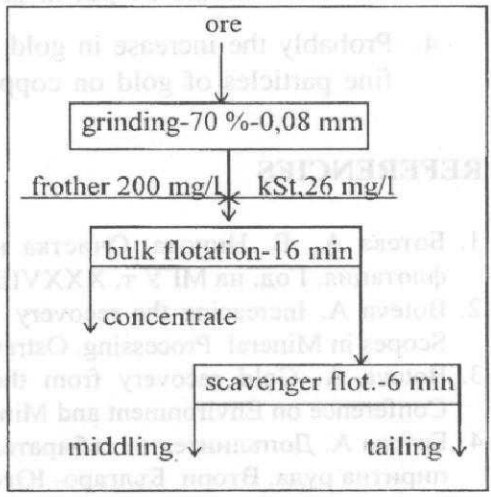


Fig. 2 : Flowsheet of the tests in open circuit with scavenger flotation

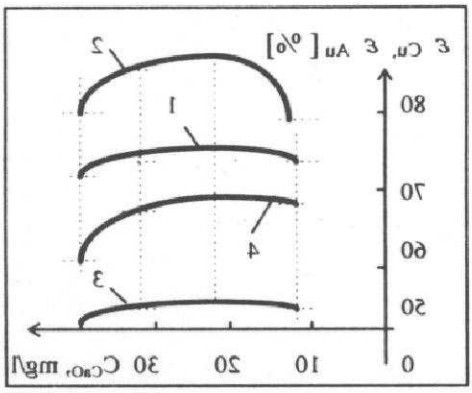


Fig. 3 : Dependence of the Cu [ε_{Cu}%] and Au [ε_{Cu}%] on ditan concentration in slurry [C_d mg/l]; 1-ε_{Cu}, %; 2-ε_{Au} %

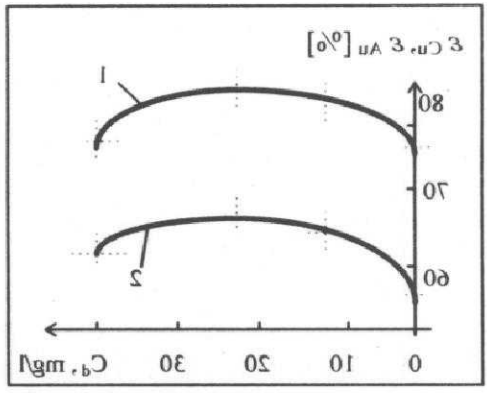


Fig. 4 : Dependence of the Cu [ε_{Cu}%] and Au [ε_{Cu}%] on CaO concentration in slurry in presence of ditan 13 mg/l, 1-ε_{Cu}% without ditan; 2-ε_{Cu}% with ditan; 3-ε_{Au}% without ditan; 4-ε_{Au}% with ditan

CONCLUSION

1. The use of ditan tope supplementary collector during flotation of copper sulphide ores helps in improving recovering copper and gold.
2. The improvement in gold recovery is due to the increase in recovery of fine gold particles. The fine gold particles are liberated from copper minerals, pyrite and silica in the process of regrinding of the bulk concentrate.
3. The ditan should be put in grinding or regrinding circuit.
4. Probably the increase in gold particles recovery is due to sticking of the fine particles of gold on copper mineral surfaces.

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