CURRENT APPLICATIONS OF MICRO - ORGANISMS IN THE LEACHING OF COPPER AND GOLD FROM CHALCOPYRITE LOW GRADE ORES

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Abstract - The conventional flotation technologies cannot provide fair results when applaid to very low grade ores or to "refractory" ores. This class includes intimate and nonuniform mineral associations, with partialy oxidized minerals and high secondary mineral content and also high soluble salt content, pre-activated minerals because of the excessive permeability of the deposit and of the intense circulation of waters with heavy metal ions etc. Bacterial oxidation as a means to the recovery of metals from sulphidic deposits has been used for thousands of years. One of the major use of biooxidation is the leaching of copper or the liberation of refractory gold where this is encapsulated in pyrite. In the Bucim copper mine Macedonia, porphiritic type, the final product from flotation is the copper concentrate consisting 20% Cu, 21g/t gold and 25g/t silver, with recoveries: 88% for copper, 60% for gold and 35% for silver. The carried out investigations of the leaching in the agitated tank involve micro-organisms, thiobacillus ferro - oxidans and thiobacillus thio-oxidans. The achieved results are following: Copper recovery 95%, gold recovery from 70-85% and silver recovery from 70-80%.

Introduction

Bucim copper and gold mine is the unique mine in the Republic of Macedonia located in the southern part of country on the south-west slopes of the Plackovica mountain. The mine is situated 130 km from the Republic capital - Skopje, 13 km from Radovis, and 2.5 km from the road connecting Stip with Strumica.

The unique copper mineralization of a porhiric type is occurring in the gneisses to their contact with the andesites. The mineral content decreases gradually with increasing distance from the contact and occurs principally as fillings and coatings on fracture plans. Andesites are barren in general, however, copper mineralization associated with fractures and joining is found in the andesites as well.

After 1979 the first tones of the copper concentrate are product. Since that time to this day the Bucim mine permanent has realised a good production - financing results including itself in the leader country companies. Mine of the open type is the basis characteristic of the Bucim mine. The mine is equipped with modern mechanisation making possible about the high productivity and good operating conditions for the operators. The process includes drilling and blasting, then blasted ore is transported towards primary crushing while the tailing on the mine disposal. The mineral Processing and ore concentration processes cover the following technological operations primary, secondary and tertiary crushing, screening and storing, grinding and classification, flotation concentration, regrinding, thickening and filtering and finally the tailing removal in tailing pond.

Laboratory and industrial investigations of the copper selective flotation in the standard and new operating conditions

Table 1.

Test	GRINDING	CONDITIONING	FLOTATION	
N^o	Collector (g/t)	Collector (g/t)	Collector (g/t)	Frother (g/t)
1	KEX:KBX=1:1	NaIPX	NaIPX	Dow - 250
2	ORFOM-C 0800	NaIPX	NaIPX	Dow - 250
3	KEX:KBX=1:1	NaIPX	ORFOM-C 0800	Dow - 250
4	KEX:KBX=1:1	NaIPX	NaIPX 15 g/t ORFOM-C 0800 10 g/t	Dow - 250
5	ORFOM-C 0800	ORFOM-C 0800	ORFOM-C 0800	Dow - 250
6	PENFLOT-3	PENFLOT-3	PENFLOT-3	Dow - 250
7a	ORFOM-C 0800 (PENFLOT-3)	NaIPX (PENFLOT-3)	NaIPX (PENFLOT-3)	Dow - 250 Dow - 250
b				

Table 2. Laboratory results - cumulative

	Grade (%) or g/t			Recovery (%)		
	Cu	Au	Ag	Cu	Au	Ag
Feed	0.33	0.52	1.11	100	100	100
C	4.85	5.70	7.40	90.2	80.7	41.2
T	0.03	0.09	0.70	9.8	9.3	58.8
∑	0.33	0.52	1.11	100	100	100

Table 3. Industrial results - cumulative

Conditions	Recovery (%)		
	Cu	Au	Ag
Standard	90.85	77.27	41.36
New-Orfom C0800	91.18	82.66	45.43
New-Penflot - 3	92.50	77.26	48.71
Varied	90.35	85.82	42.20

Laboratory investigations of the leaching and bioleaching

Table 4. Laboratory results - cumulative

Conditions	Recovery (%)		
	Cu	Au	Ag
Leaching	93.4	84.7	75.4
Thiobacillus fero-oxidans	96.5	86.8	81.2
Leptospirilum fero-oxidans	95.4	84.7	85.0

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