

Experimental study on mineral processing of shallow oxidation ore in a hydrothermal metasomatic sulfide gold mine

Xiangwei Qin^{1*}, Guangsheng Li¹, Xingfu Zhu¹, Zhiming Zhang², Mingming Cai¹

¹Shandong Gold Mining Technology Co., Ltd., Shandong Laizhou 261441 China

²Fujian Zhenghe County Yuanxin Mining Co., Ltd., Fujian Zhenghe 353600 China

Abstract: The ore produced by a gold mine in Fujian province belongs to hydrothermal metasomatism sulfide type gold (silver) ore, and the shallow oxidized ore of the deposit has a gold grade of 0.91g/t. In order to understand the selectability of this oxidized ore, the selectability test study is carried out. Through the beneficiation test study, the concentration of -0.074mm is 70%, the concentration of isooxyl yellow is 150g/t, the concentration of butyl ammonium black is 50g/t, and the concentrate products of 16.98g/t can be obtained, and the gold recovery rate is 74.04%.

1. Introduction

In recent years, the gold price has risen sharply and reached record highs for many times, which has greatly promoted the development of the exploitation and recycling of gold mineral resources. With the continuous exploitation and utilization of gold-containing mineral resources, the relatively easy mining and easy dressing decreases year by year, and the relative shortage of resources is intensified, and small lean ore, multi-element symbiotic ore and mixed-containing ore become the main exploitation mineral sources. Therefore, the application research and development of low-grade oxidized ore has attracted great attention. This type of mineral is generally characterized by fine immersion shape and large mud content.^{[1]-[8]}

Fujian source xin company source xin mine output belongs to hydrothermal metasomatism sulfide gold

(silver) ore,^[9] the shallow deposit occurrence of oxidized ore, the oxidized ore oxidation degree is low, gold grade 0.91g/t, because of shallow mining cost is low, and the gold price is high, although the gold grade is low, but still has a high mining recycling value. Through the beneficiation test study, the best process control parameters are determined, and the gold recovery rate can reach 74.04%, and the economic benefits are considerable.^[10]

2. Proto-Mineral Properties

The gold minerals in raw ore are mainly silver gold, and a small amount of gold and silver metal minerals,^[11] gangue minerals are quartz, feldspar, mica, chlorolite, ferric alumite, whole column, calcium zeolite, chlorite, calcite. The results of the multielement analysis of the raw ore are shown in Table 1.

Table.1 Multi-element analysis results of raw ore

| element | Au(g/t) | Ag(g/t) | Cu | Pb | Zn | S | Fe | As | C |
|-----------|----------|----------|------|-------|------|------|------|------|------|
| grade (%) | 0.91 | 25.42 | 0.01 | <0.01 | 0.01 | 0.36 | 1.15 | 0.03 | 0.04 |

The results showed that the Au grade is 0.91g/t, Ag grade is 25.42g/t, Cu, Pb and Zn content are low, S content is 0.36%, As and C low content.

3. Flotation Condition Test

3.1. Test process

The test process of flotation conditions, after the raw ore is ground, use a coarse selection and a sweep, coarse selection for 4 minutes and sweep for 5 minutes. The principle flow of flotation test is shown in Figure 1.

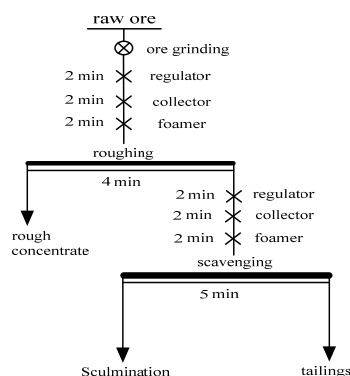


Figure.1 Princiflow of flotation test

*Corresponding author: 287506806@qq.com

3.2. Grinding fineness test

The test raw ore was ground to control the content of -0.074mm 60%, 65%, 70%, 70%, 75%, 80%, the amount of isopyl yellow 150g / t, the amount of ammonium black 50g/t, and the amount of foaming agent 25g/t. The test results are shown in Figure 2.

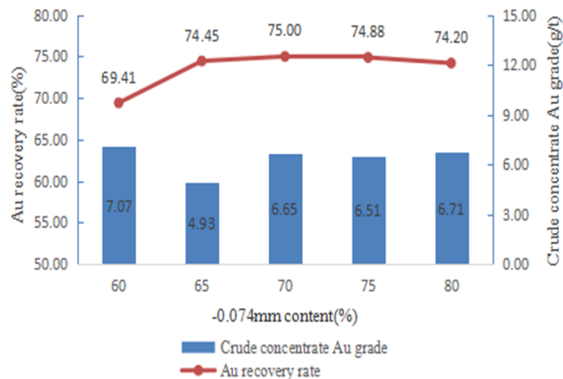


Figure.2 Au grade recovery and grinding fineness of coarse concentrate

The test results show that with the increase of grinding fineness, the Au recovery rate increases first and then decreases. When the grinding fineness is -0.074mm at 70%, the highest Au recovery rate is 75.00%. After the grinding fineness reaches -0.074mm at 70%, the phenomenon of "overgrinding" occurs, and the Au recovery rate is decreased. Overall, the optimal grinding fineness was determined to be -0.074mm at 70%.

3.3. Test of collector species

The test raw ore was ground, controlling the fineness of -0.074mm content 70%, the amount of 200g/t, foaming agent of 25 g/t to determine the best harvesting agent. Capture species are shown in Table 2 and test results are shown in Figure 3.

Table.2 Collection species

| Capture species number | collecting agent |
|------------------------|---|
| No.1 | Isovalyl yellow medicine: butyammonium black medicine =3:1 |
| No.2 | DT-2 |
| No.3 | Y89 |
| No.4 | Z200-1 |

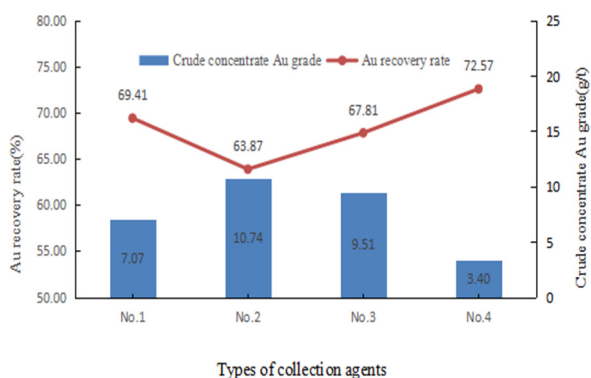


Figure.3 Plot of Au grade and recovery rate and collector

species of crude concentrate

The test results show that under the same flotation conditions, No.4>No.1>No.3>No.2, from the coarse concentrate gold grade, No.2>No.3>No.1>No.4. Based on Au grade and Au recovery rate of crude concentrate, the mixture of isopyl yellow drug and butyric ammonium black drug was used.

3.4. Isoperyl yellow drug dosage test

The test raw ore was ground, the content of the grinding fineness -0.074mm was 70%, the dosage of isoperyl yellow was 90g/t, 120g/t, 150g/t, 180g/t, 210g/t, pharmacological dosage of ammonium butyrate was 50g/t, and the dosage of foaming agent was 25g / t to determine the better dosage of isoperyl yellow. The test results are shown in Figure 4.

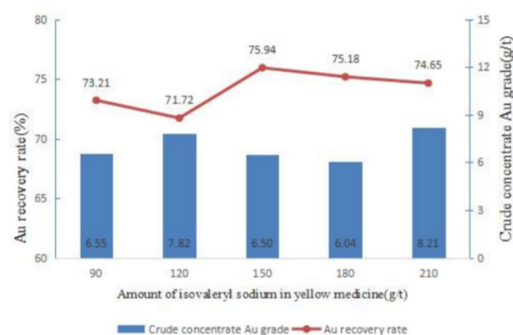


Figure.4 The relationship between Au grade and recovery of crude concentrate and the dosage of isoperyl yellow

The test results show that with the increase of isopyl yellow dosage, the Au recovery rate shows a trend of gradually increasing. When the dosage is 150g/t, the recovery rate of Au will not be significantly increased, and the grade of Au in crude concentrate is decreasing continuously. Overall, the dosage of isopyl yellow was determined to be 150g/t.

3.5. Ding ammonium black drug dosage test

The test raw ore was ground, controlling the fineness of -0.074mm was 70%, the medicinal amount of isoperyl yellow was 150g/t, the amount of butyric ammonium black was 0g/t, 25g/t, 50g/t, 75g/t, 100g/t, 125g/t, and the dosage of foaming agent was 25g/t, to determine the better medicinal amount of butyric ammonium black. The test results are shown in Figure 5.

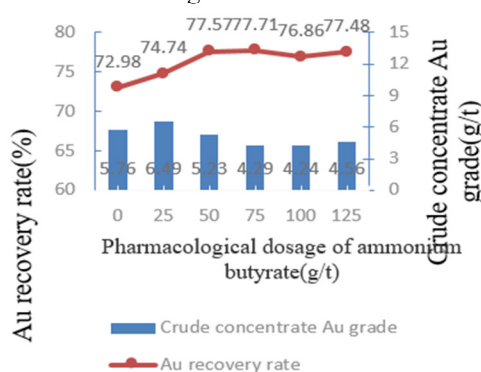


Figure.5 The relationship between Au grade and recovery of crude concentrate and the dosage of butylamium black

The test results show that with the increase of the dosage of butyammonium black, the recovery of Au is gradually increasing. When the dosage is 50g/t, the recovery of Au in the increasing dosage is not obvious, and the grade of concentrate Au is constantly decreasing. Overall, the dosage of butyammonium black was determined to be 50g/t.

3.6. Flytation concentration test

The test raw ore was ground, and the fineness of-0.074mm was 70%, the amount of yellow drug was 150g/t, the amount of ammonium black was 50g/t, and the amount of foaming agent was 25g/t. The flotation concentration was controlled at 23%, 26%, 29%, 32%, 35%, 38% and 41% respectively. The test results are shown in Figure6.

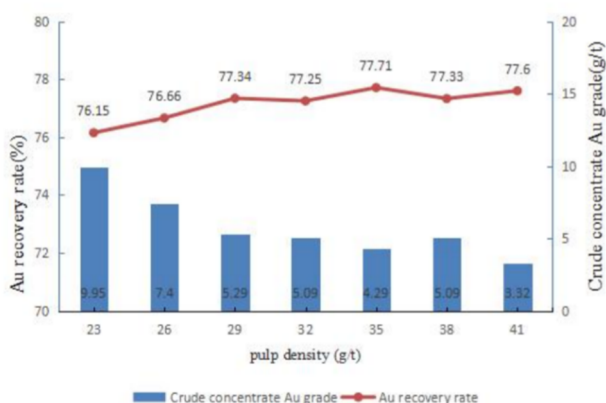


Figure.6 Plot of Au grade and recovery and slurry concentration of coarse concentrate

The test results show that with the increase of flotation concentration, the recovery rate of Au is gradually increasing. When the flotation concentration is 29%, the increasing flotation concentration of Au does not increase significantly, and the grade of concentrate Au is constantly decreasing. Combined, the flotation concentration was determined to be 29%.

4. Flotation Time Test

The test raw ore was ground to control the fineness of-0.074mm70%, the flotation concentration was 29%, the amount of isopyl yellow was 150g / t, the amount of butyammonium black was 50g/t, and the amount of foaming agent was 25g/t, and the better flotation time was determined. The test results are shown in Table 3.^[12]

The test results show that with the extension of flotation time, the recovery rate of Au is constantly improved. When the flotation time is 21min,^[13] the flotation time continues to be extended, and the recovery rate increase is not obvious, and the flotation time is tentatively set at 21min. The second coarse selection and three sweep process were selected to determine the flotation time of 5min, 5min, 4min, 4min and 3min respectively.

Table.3 Flotation time test results

| Flotation time (min) | | sample name | Au grade (g / t) | | productivity (%) | | Au retrieve (%) | |
|----------------------|--------------------|---------------|------------------|---------------------|------------------|---------------------|-----------------|--------------------|
| individual | accumulative total | | individual | Cumulative tailings | individual | Negative cumulative | individual | accumulative total |
| 4 | 4 | Thick essence | 4.2 | 0.99 | 14.01 | 100.00 | 59.23 | 59.23 |
| 4 | 8 | middling1 | 1.88 | 0.47 | 9.01 | 85.99 | 17.04 | 76.27 |
| 3 | 11 | middling2 | 1.25 | 0.31 | 4.37 | 76.98 | 5.50 | 81.77 |
| 3 | 14 | middling3 | 1.25 | 0.25 | 3.59 | 72.61 | 4.51 | 86.28 |
| 3 | 17 | middling4 | 0.69 | 0.20 | 2.69 | 69.02 | 1.87 | 88.15 |
| 2 | 19 | middling5 | 1.11 | 0.18 | 0.74 | 66.33 | 0.83 | 88.98 |
| 2 | 21 | middling6 | 0.70 | 0.17 | 0.49 | 65.59 | 0.35 | 89.33 |
| 1 | 22 | middling7 | 0.43 | 0.16 | 0.33 | 65.10 | 0.14 | 89.47 |
| 1 | 23 | middling8 | 0.43 | 0.16 | 0.38 | 64.77 | 0.16 | 89.63 |
| | | tailings | 0.16 | 0.16 | 64.39 | 64.39 | 10.37 | 100.00 |
| amount to | | | 0.99 | | 100.00 | | 100.00 | |

5.Closed Circuit Test

Under the best process conditions determined by flotation condition test, the grinding fineness of-0.074mm of 70%, the flotation concentration of 150g / t, butyl ammonium black of 50g / t, foaming agent of 25g / t, and the three selection process for flotation closed circuit test. The test results are shown in Table 4.

Table 4 Results of flotation closed circuit test

| Sample name | grade (g/t) | productivity (%) | percent recovery (%) |
|------------------|-------------|------------------|----------------------|
| Gold concentrate | 16.98 | 3.98 | 74.04 |
| tailings | 0.25 | 96.02 | 25.96 |
| amount to | 0.91 | 100.00 | 100 |

After closed circuit test, the concentrate products with yield of 3.98% and Au grade 16.98g/t can be obtained, and the recovery rate of flotation Au is 74.04%.

6. Conclusion

Some oxidized ore of a hydrothermal metatomatic sulfide gold deposit contains 0.91g/t, the gold mineral is mainly silver gold mine, a small amount of gold and silver ore, Ag grade is 25.42g/t, Cu, Pb and Zn content is low, S content is 0.36%, As and C low content.

Through the experimental study of flotation conditions, it is determined that the fineness content of the better mill is 0.074mm and 70%, the collector is 150g/t, 50g/t, the flotation concentration is 29%, and the flotation time is 21min.

The closed circuit test was carried out by using the secondary rough selection and three sweeps, and the concentrate products with yield of 3.98% and Au grade 16.98g/t were obtained. The recovery rate of Au in flotation was 74.04%, and the test index was ideal.

Through experimental research, Fujian Yuanxin Company has carried out comprehensive recovery and utilization of shallow low-grade oxidized gold ore in the deposit. Practice has proved that the recovery effect can basically reach the expected test index, which provides a successful reference for other gold mines in the recovery and utilization of low-grade oxidized gold ore.

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