



Experimental study on optimization and improvement of flotation index of altered rock and quartz vein ore in a gold mine

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Abstract. A gold concentrator mainly processes quartz vein ore and altered rock ore. The average tailings grade in flotation production is about 0.13 g / t, and the recovery rate is about 90 %. In order to further improve the production index, the process mineralogy detection and flotation test of the two ores were carried out. The test process completely simulated the on-site production process, which was a one-stage roughing + two-stage scavenging process, and the collector was isoamyl xanthate. The test data and experimental data show that the gold-bearing minerals in altered rock ore are finely disseminated, and the composition of sulfide minerals is more complex than that of quartz vein ore. The optimum grinding fineness of quartz vein ore is 45 %, the dosage of collector is 80g / t, and the index stability is good. The optimum grinding fineness of altered rock ore is 60 %, the dosage of collector is 100g / t, and the dosage of collector and grinding fineness are insufficient, which will lead to the obvious deterioration of flotation tailings and recovery index.

Keywords: gold mine; Flotation; Process mineralogy; rate of recovery; Concentrate; tailings.

1 Introduction

A gold ore dressing plant mainly deals with quartz vein ore and altered rock ore. Due to the different properties of the two kinds of ore, the production indexes of the two kinds of ore are obviously different ^[1], and the production indexes fluctuate greatly; the production index fluctuates greatly; the tailings grade of quartz vein ore in production is about 0.08 g / t, and the recovery rate is 92 %. The tailings grade of altered rock ore is about 0.15 g / t, and the recovery rate is 86 %. In order to solve the above problems, the process mineralogy of the two ores was tested, and the occurrence state and particle size distribution of the gold minerals in the samples were clarified ^[2-6]. Flotation tests were carried out to determine the best flotation process conditions for the two ores, and the existing process parameters were optimized and adjusted with reference to the test

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data to achieve the purpose of stabilizing the production process and improving the process indicators [7].

2 Ore properties

The process mineralogy test of quartz vein ore and altered rock ore was carried out, and the gold element and gold-bearing mineral dissemination characteristics, gold occurrence state and gold-bearing mineral particle size distribution of the two ores were clarified.

The gold grade in the quartz vein ore is 1.30 g / t. The gold minerals are mainly electrum and gold-silver ore, and the gold content accounts for 76.81 % and 23.19 % respectively. There are also pyrite, galena, sphalerite and other metal minerals; gangue mainly includes dolomite, quartz, calcite, fluorite, feldspar, mica and so on. The gold mineral is mainly associated with pyrite [8]. The content of gold mineral is 81.81 %, the content of monomer gold mineral is 8.69 %, the content of gold mineral associated with galena is 1.76 %, the content of gold mineral associated with sphalerite is 3.68 %, and the content of gold mineral associated with quartz is 4.06 %. The gold minerals mainly exist in the form of bare gold with a content of 85.24 %, and the wrapped gold content is 14.76 %. The average particle size of gold minerals is 5.57 μm , which is mainly fine-fine grained.

The grade of gold in the altered rock ore is 1.26 g / t. The gold minerals are mainly electrum and gold-silver ore, and the gold content accounts for 62.37 % and 37.63 % respectively. There are also pyrite, galena, sphalerite and other metal minerals ; gangue mainly includes dolomite, quartz, calcite, fluorite, feldspar, mica and so on. The gold minerals are mainly associated with pyrite. The content of gold minerals accounts for 47.02 %, the content of monomer gold minerals accounts for 10.70 %, the content of gold minerals associated with galena accounts for 4.65 %, the content of gold minerals associated with sphalerite accounts for 28.75 %, the content of gold minerals associated with quartz accounts for 6.37 %, and the content of gold minerals associated with sericite accounts for 2.51 %. Gold minerals mainly exist in the form of bare gold with a content of 76.63 %, and the content of wrapped gold is 23.37 % (the content of inter-granular gold is 3.56 % [9]). The average particle size of gold minerals is 5.03 μm , which is mainly fine-fine grained.

3 Experimental study on flotation of quartz vein ore

According to the purpose of the test, the flotation test of grinding fineness condition and the test of collector dosage were carried out on the quartz vein ore respectively. The test process completely simulated the field process, and the flotation process of one roughing two scavenging was adopted.

3.1 Flotation test of grinding fineness condition

Flotation tests were carried out under the conditions of grinding fineness-200 mesh content of 40 %, 45 %, 50 %, 55 %, 60 % and 65 %, respectively, to determine the best grinding fineness of quartz vein ore. The flotation time was 4 minutes for roughing, 3 minutes for scavenging 1 and 3 minutes for scavenging 2. The specific process is shown in Fig. 1, and the test results are shown in Fig. 2.

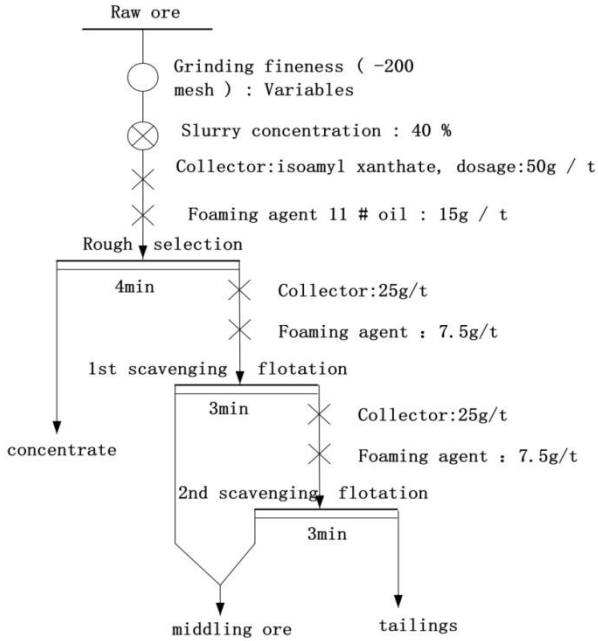


Fig. 1. Flotation test process

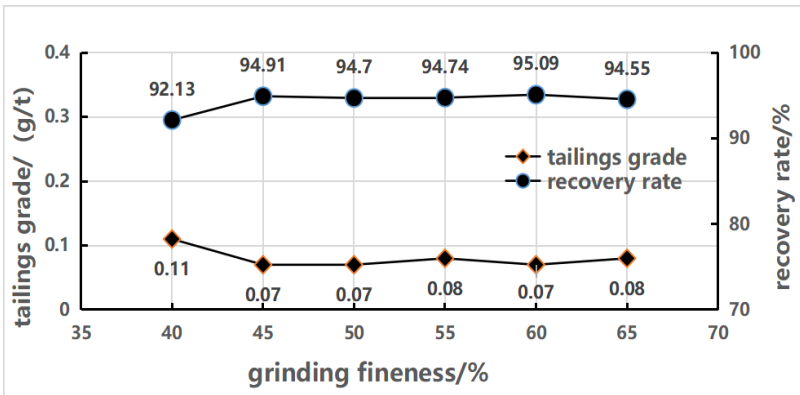


Fig. 2. The relationship diagram of flotation tailings grade, recovery rate and grinding fineness

It can be seen from the test results that when the grinding fineness reaches 45 %, the gold recovery rate is 94.91 %. If the grinding fineness continues to increase, the gold recovery rate will no longer increase significantly and stabilize at about 95 %. The tailings grade showed a downward trend. When the grinding fineness reached 45 %, the tailings grade was 0.07g / t. When the grinding fineness continued to increase, the tailings grade fluctuated less and stabilized at 0.07g / t-0.08g / t. Therefore, the best grinding fineness of quartz vein ore is 45 %.

3.2 Flotation test of collector dosage condition

Under the conditions of grinding fineness-200 mesh content of 45 %, flotation concentration of 40 % and collector of isoamyl xanthate, the condition test of collector dosage was carried out. The test results are shown in Fig. 3.

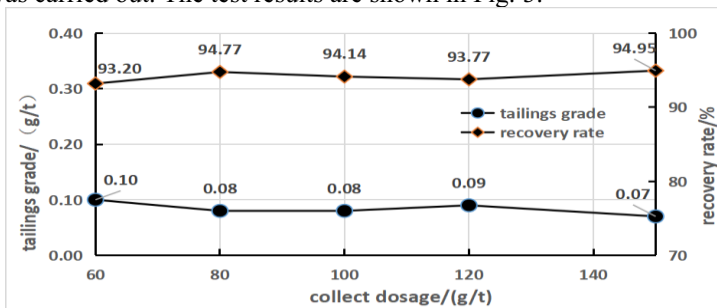


Fig. 3. Relationship diagram of flotation tailings grade, recovery rate and collector dosage

According to the test results, when the dosage of collector reaches 80 g / t, the total recovery rate of concentrate and middling is 94.77 %. If the dosage of collector continues to increase, the recovery rate will not increase significantly. When the dosage of collector is 80g / t, the flotation recovery rate and tailings grade index are relatively good, and the dosage is low, so the recommended dosage is 80g / t.

4 Experimental study on flotation of altered rock ore

According to the purpose of the test, the grinding fineness condition flotation test, collector dosage test and flotation closed circuit test were carried out on the altered rock ore.

4.1 Flotation test of grinding fineness condition

The flotation test was carried out under the conditions of grinding fineness-200 mesh content of 40 %, 45 %, 50 %, 55 %, 60 % and 65 %, respectively, to determine the optimal grinding fineness of altered rock ore. The flotation time was 4 minutes for roughing, 3 minutes for sweeping 1 and sweeping 2, respectively. The test results are shown in Fig.4.

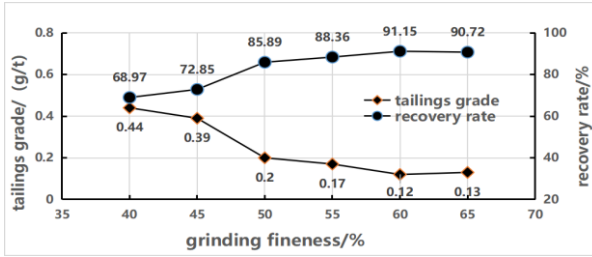


Fig. 4. The relationship diagram of flotation tailings grade, recovery rate and grinding fineness

It can be seen from the test results that when the grinding fineness reaches 60 %, the recovery rate is 91.15 %. If the grinding fineness continues to increase, the gold recovery rate will no longer increase and stabilize at about 91 %. The tailings grade decreases with the increase of grinding fineness. When the grinding fineness reaches 60 %, the tailings grade is 0.12 g / t. If the grinding fineness continues to increase, the tailings grade will no longer decrease. Therefore, the best grinding fineness of altered rock ore is 60 %.

4.2 Flotation test of collector dosage condition

Under the conditions of grinding fineness-200 mesh content of 60 %, flotation concentration of 40 % and collector of isoamyl xanthate, the condition test of collector dosage was carried out. The test results are shown in Fig. 5.

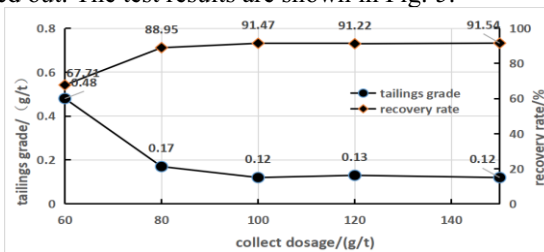


Fig. 5. Relationship diagram of flotation tailings grade, recovery rate and collector dosage

According to the test results, when the dosage is increased to 100 g / t, the recovery rate reaches 91.47 %, the tailings grade reaches 0.12 g / t, and the recovery rate reaches 91.47 %. Continue to increase the dosage of the agent, the tailings grade and recovery rate have no obvious change. Therefore, the recommended dosage of collector is 100g / t.

5 Conclusion

1) The best grinding fineness of quartz vein ore-200 mesh content 45 %, collector isoamyl xanthate dosage 80 g / t; the optimum grinding fineness of altered rock ore is 60 % of-200 mesh content, and the dosage of collector isoamyl xanthate is 100g / t.

2) Through the process mineralogy test of the two ores, it can be seen that the content of gold minerals associated with quartz in quartz vein ores accounts for 4.06 %, the content of gold minerals associated with quartz in altered rock ores accounts for 6.37 %, and the content of gold minerals associated with sericite accounts for 2.51 %. Because the gold minerals associated with gangue are difficult to be separated, the flotation recovery rate of quartz vein ore is about 96 % in theory, and the flotation recovery rate of altered rock ore is about 91 %, which is consistent with the experimental data.

3) Quartz vein ore has relatively loose requirements on process conditions and good index stability; the altered rock ore has high requirements for process conditions. The lack of collector dosage and grinding fineness will lead to the obvious deterioration of flotation tailings and recovery index.

4) Through the flotation condition test, the optimum grinding fineness and reagent dosage of the two ores were proved. The main reason for the poor production index is that the process conditions are not strictly controlled. In production, the production process parameters of the two ores should be strictly controlled according to the optimum process conditions determined by the test, so as to achieve the purpose of stabilizing the process and improving the production index.

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