Experimental Study on Regrinding Flotation of a Gold Mine in Gansu Province

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Abstract. The gold mineral in a difficult to select gold mine has a relatively fine particle size, with an average particle size of 3.58 μ m. Mainly in the form of fine-grained embedding. The main gold bearing mineral is pyrite, with an average particle size of 32.80 μ m. 20 μ The content of particles below m is 33.84%, and the content of fine particles is relatively high. Due to the fine particle size of gold ore and gold bearing mineral pyrite, it belongs to difficult to select gold ore. The flotation recovery rate of conventional beneficiation process is about 80%. In order to further improve the flotation recovery rate of this difficult to select gold mine, experimental studies were conducted on the "intermediate ore re grinding flotation" and "intermediate ore coarse particle re grinding flotation" of the flotation intermediate ore, and based on the experimental research, on-site process flow transformation measures were proposed.

Keywords: Difficult to select gold mines; Re grinding; flotation.

1 Introduction

A certain gold mine beneficiation plant adopts a one-stage grinding process, and the grinding fineness of the selected raw ore is controlled at around -200 mesh 75%. Due to the fact that the pyrite, which is the main gold bearing mineral in the selected raw ore, is distributed in a fine-micron particle pattern (with an average particle size of 32.80μ m) A stage of grinding cannot achieve sufficient dissociation of pyrite, which affects the gold grade and recovery rate of flotation concentrate. However, adding a grinding section (requiring the addition of a ball mill) not only increases equipment investment and energy consumption, but also occupies the already limited factory space. In order to further improve the gold grade and recovery rate of flotation concentrate, reduce the occupation of factory space, and reduce equipment investment and energy consumption, a re grinding experiment was carried out for flotation intermediate ore (the amount of ore selected in flotation is significantly reduced compared to the original ore,

A. E. Abomohra et al. (eds.), *Proceedings of the 2023 9th International Conference on Advances in Energy Resources and Environment Engineering (ICAESEE 2023)*, Atlantis Highlights in Engineering 29,
https://doi.org/10.2991/978-94-6463-415-0_54

achieving precise grinding of pyrite continuous body, reducing equipment investment and grinding process energy consumption), to determine the feasibility of re grinding flotation intermediate ore and the re grinding process. For this purpose, experimental studies were conducted on the "intermediate ore regrinding flotation" and "intermediate ore coarse particle regrinding flotation" of flotation intermediate ores provided on the production site. The results showed that the recovery rate of "coarse particle regrinding flotation" after mixing six flotation intermediate ores (equivalent to full particle size) was 21.80% higher than that of unground, which was higher than the recovery rate of direct regrinding flotation after mixing one, two, three, one, and two fine tailings (5.87%). Based on this, a transformation measure of "intermediate ore classification coarse particle separate re grinding flotation" is proposed.[1-3]

2 Sample analysis

Perform laboratory analysis on the incoming samples, and the results are shown in Table 1.

Table 1. Test and analysis results

Sample name	Gold grade/(g/t)	Sulfur grade/%
Flotation concentrate	24.38	35.54
Primary cleaner tailing	5.64	6.44
Secondary cleaner tailing	6.68	8.42
Thirdly cleaner tailing	13.35	18.25
Primary scavenger concentrate	5.01	4.39
Secondary scavenger concentrate	3.84	4.01
Thirdly scavenger concentrate	3.18	3.29
Flotation tailings	0.45	0.21

3 Particle size sieving analysis

Particle size analysis was performed on 8 samples including concentrate, with a focus on examining three particle sizes:+100 mesh, -100+200 mesh, and -325 mesh. The results are shown in Tables 2.

Table 2. Sample+100 mesh sieve analysis results

Sample name	Yeild/%	Gold grade/(g/t)	Au distribution rate/%	Sulfur grade/%	Sulfur distribution rate/%
Flotation concentrate	0	0	0	0	0
Primary cleaner tailing	11.95	5.92	12.53	4.1	7.61
Secondary cleaner tailing	12.71	6.19	11.78	3.72	5.62
Thirdly cleaner tailing	12.08	13.76	12.45	7.14	4.73
Primary scavenger concentrate	12	5.17	12.38	3.86	10.88
Secondary scavenger concentrate	10.44	4.16	11.32	4.26	11.09
Thirdly scavenger concentrate	8.79	4.42	12.22	2.68	7.16
Flotation tailings	5.31	0.71	8.38	0.28	7.24

Ten test samples were screened using a standard sieve for particle size analysis. The screening results showed that the+100 mesh particle size content in the flotation concentrate (three fine tailings and three sweeping concentrates) was about 10%, and the gold distribution rate was about 12%. However, the+100 mesh particle size content in the concentrate was zero, indicating that all 12% of the+100 mesh gold in the flotation concentrate did not enter the concentrate. Therefore, it is necessary to conduct experimental research on coarse particle size re grinding and flotation of the flotation concentrate.

4 Experimental study[4-7]

4.1 Flotation Middling regrinding - flotation test

Six flotation samples were finely ground and then subjected to roughing.The changes in gold grade and recovery rate of the flotation concentrate were examined to determine the suitable samples for re grinding flotation treatment and the grinding fineness. The experimental process and conditions are shown in Figure 1.

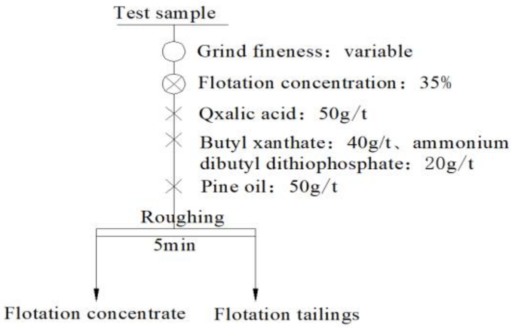

Fig. 1. Test Process

Table 3. Test Results

	Sample name	Optimal grinding fine-ness(-200 mesh)/%	Unground ore sample flotation concentrate		Flotation concentrate under optimal grinding fineness conditions	
			Gold grade/(g/t)	Rate of recov-ery/%	Gold grade/(g/t)	Rate of recov-ery/%
Flota-tion Mid-dling	Primary cleaner tailing	67	5.89	90.69	7.23	93.87
	Secondary cleaner tailing	65	7.10	92.16	8.18	94.98
	Thirdly cleaner tailing	58	13.92	97.77	15.15	97.59
	Primary scavenger con-centrate	82	5.36	86.63	7.41	90.03
	Secondary scavenger concentrate	71	4.54	80.73	5.17	87.99
	Thirdly scavenger con-centrate	65	4.08	79.15	4.21	89.64
Mixed Flota-tion Mid-dling	Scavenger concentrate	76	4.99	84.33	6.23	88.3
	Scavenger concen-trate+Primary cleaner tailing+Secondary cleaner tailing	66	6.92	84.17	7.97	90.04

According to Table 3, except for the refined three tailings, the gold grade and recovery rate of the flotation concentrate after regrinding in the other five flotation processes have all been improved to varying degrees. Considering that in the actual production process, the flotation concentrate should be mixed before regrinding, and the first, second, and third concentrates should be mixed in a certain proportion before grinding flotation treatment. When the grinding fineness is -200 mesh and the content is 76%, the flotation recovery rate is 3.97% higher than that without grinding. Mix the first, second, third, first, and second tailings in a certain proportion before grinding. When the grinding fineness is -200 mesh and the content is 66%, the flotation is 5.87%

higher than that without grinding. Compared to the two, the recovery rate of grinding flotation after mixing the first, second, third, first, and second tailings is higher.

4.2 Coarse particle regrinding flotation test of Flotation Middling

Use a standard sieve to screen out the ore with a particle size of 200 mesh or more from six flotation tailings, namely, sweeping one fine, sweeping two fine, sweeping three fine, sweeping one fine, sweeping two fine, and sweeping three fine. Conduct further grinding flotation tests on the coarse particle size of 200 mesh or more to examine the changes in gold grade and recovery rate of the flotation concentrate. The experimental process and conditions are shown in Figure 2.

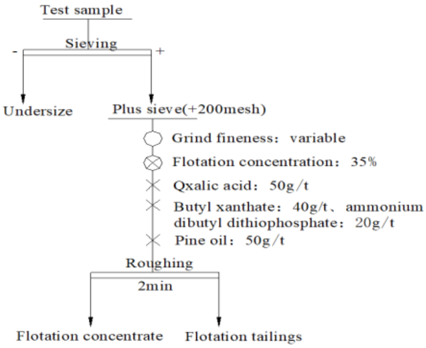

Fig. 2. Test Process

Table 4. Test Results

Sample name		Optimal grinding fineness(-200mesh)/%	Unground ore sample flotation concentrate		Flotation concentrate under optimal grinding fineness conditions	
			Gold grade/(g/t)	Rate of recovery/%	Gold grade/(g/t)	Rate of recovery/%
Flotation Middling(+200mesh)	Primary cleaner tailing	54	5.87	32.56	8.11	69.05
	Secondary cleaner tailing	53	7.48	36.17	9.33	79.43
	Thirdly cleaner tailing	51	14.31	49.31	18.85	82.68
	Primary scavenger concentrate	50	5.23	25.78	6.9	58.98
	Secondary scavenger concentrate	48	4.77	32.9	6.45	65.23
	Thirdly scavenger concentrate	72	4.54	27.52	7.78	55.34
Mixed Flotation Middling(+200mesh)	Cleaner tailing+Scavenger concentrate	51	6.74	31.7	10.6	74.91

According to Table 4, it can be seen that the recovery rates of the flotation concentrate after coarse particle regrinding of the six flotation Middlings have been improved to varying degrees, and are all higher than the recovery rates of the direct regrinding flotation of the six Middlings. The recovery rate of "coarse particle regrinding flotation" after mixing six flotation samples increased by 43.21% compared to ungrounded samples. Comparative experiments under different reaction time.

5 Conclusion

The experimental research results show that the gold grade of the flotation concentrate increased by 3.86g/t and the recovery rate (equivalent to the full particle size) increased by 21.80% after the coarse grade re grinding of the flotation intermediate ore (sweeping and finishing), which is much higher than the gold grade of 1.05g/t and the recovery rate of 5.87% after the mixed intermediate ore re grinding. In addition, only regrinding coarse particles can significantly reduce the amount of regrinding and avoid interference and overgrinding of fine particles. Therefore, the "coarse particle regrinding flotation" treatment method is suitable for medium ore.

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