

R. 607. Selective flotation of vanner tailings from the King Island Scheelite mill

In the King Island Scheelite mill the scheelite rougher flotation concentrate is cleaned twice by flotation and then is returned to the conditioner prior to rougher flotation. No attempt is made to remove sulphides prior to scheelite flotation and consequently the sulphides float with the scheelite and eventually some of the sulphides report in the vanner tails for return to rougher flotation.

The only means of escape for the sulphides from this circuit is by way of the rougher flotation tail or by way of the vanner concentrate. The sulphides are in a condition in which they will float readily, and hence the likelihood of them appearing in the rougher tail under normal conditions is remote. The sulphides (mainly pyrite and molybdenite) are lighter than the scheelite and therefore tend to report in the vanner tailing. Thus large circulating loads of sulphides would be commonplace in this circuit.

A sample of vanner tailing was brought to the Department of Mines by J. Sievers of King Island Scheelite, for an attempt to find selective conditions in which either the sulphides could be floated away from the scheelite or the scheelite away from the sulphides.

SAMPLE

The sample (about 5 gallons) of vanner tailing was in pulp form taken from the King Island Scheelite mill.

Samples for individual tests were taken by removing two litres of the pulp, while the pulp was well stirred. The remaining pulp, after the series of tests were completed, was used as the head sample.

TEST PROCEDURE

All flotation tests were conducted on two litres of pulp in the Denver D-1 'Sub-A' laboratory flotation machine, with an impeller speed of 1,500 rpm. The weight of dry feed in each test was approximately 350 g.

The following conditions were applied in individual tests.

Test N1

Flotation for 5 minutes with no reagent additions.

Test N2

Conditioning with 1 g of sodium sulphite for 5 minutes followed by flotation for 5 minutes.

Test N3

Conditioning with 1 g of sodium sulphite for 15 minutes followed by flotation for 5 minutes.

Test N4

Conditioning with 0.5 g of I.C.I. reagent Alkanate ND for 5 minutes followed by flotation for 5 minutes.

Test N5

Conditioning with 0.2 g of I.C.I. reagent Vantoc CL for 5 minutes followed by flotation for 5 minutes. The concentrate was refloatated for 5 minutes.

Test N6

Conditioning with 0.5 g of oxalic acid and 0.5 g of sulphuric acid for 5 minutes followed by a further 3 minutes conditioning with an additional 0.5 g of oxalic acid. Flotation followed for 4 minutes. At the end of flotation the pH of the pulp was determined and found to be 8.1; 0.1 g of sodium ethyl xanthate and 3 drops of cresylic acid were added to the remaining pulp and conditioning for 1 minute was carried out followed by 3 minutes flotation to produce a second concentrate.

Test N7

Flotation for 5 minutes with no reagents. The concentrate was conditioned for 5 minutes with 0.2 g of Vantoc CL and floated for 5 minutes to give a cleaner concentrate. The cleaner concentrate was conditioned for 5 minutes with 0.2 g of Vantoc CL and floated for 5 minutes to give a recleaner concentrate.

Test N8

Conditioning with 0.5 g of oxalic acid, 0.5 g of sulphuric acid and 0.1 g of sodium ethyl xanthate for 5 minutes followed by 3 minutes flotation. The concentrate was floated for 5 minutes in a cleaning operation. Two concentrates were taken in this operation: one for 3 minutes flotation and the other concentrate for the remaining 2 minutes flotation.

The series of tests was conducted while Mr Sievers was present, and was completed before any assaying was done.

The tests in which Vantoc CL and oxalic acid were used appeared to give conditions in which sulphides were being selectively floated away from the scheelite.

The test products were halved by riffing. One half of each sample was kept by the Department of Mines. The other half of each sample was forwarded to King Island Scheelite for WO₃ and S assays.

RESULTS

The results of each test are shown in Table 1.

DISCUSSION

All reagents except for reagent Alkanate ND gave results that were more selective than the blank test (N1) in which no reagents were added.

Two reagents in particular gave results which indicate that their use could be beneficial in the existing situation at King Island Scheelite where bulk flotation of sulphides is practised. These reagents are Vantoc CL and oxalic acid used in conjunction with sulphuric acid.

In test N5 in which Vantoc CL was used in rougher flotation, the rougher flotation tail contained 78.6% of the WO₃ and assayed 19.0% WO₃ and 1.22%

Table 1. TEST RESULTS

Test	Product	% Wt	Assay %		Distribution %	
			WO ₃	S	WO ₃	S
N1	FC	62.5	8.8	4.55	46.9	92.3
	FT	37.5	16.6	0.63	53.1	7.7
	Comp. F/D	100.0	11.7	3.08	100.0	100.0
N2	FC	54.2	8.0	5.13	36.9	89.9
	FT	45.8	16.2	0.68	63.1	10.1
	Comp. F/D	100.0	11.8	3.09	100.0	100.0
N3	FC	48.2	8.0	6.12	33.3	90.9
	FT	51.8	14.9	0.57	66.7	9.1
	Comp. F/D	100.0	11.6	3.25	100.0	100.0
N4	FC	64.2	8.5	4.12	46.7	85.9
	FT	35.8	17.4	1.21	53.3	14.1
	Comp. F/D	100.0	11.7	3.08	100.0	100.0
N5	F2C	36.6	2.2	6.64	6.7	69.2
	F2T	13.5	13.2	3.52	14.7	13.5
	Comp. F1C	50.1	5.2	5.80	21.4	82.7
	F1T	49.9	19.0	1.22	78.6	17.3
	Comp. F/D	100.0	12.1	3.51	100.0	100.0
N6	FC1	20.7	7.2	10.37	12.9	64.7
	FC2	11.7	7.0	6.76	7.1	23.9
	FT	67.6	13.7	0.56	80.0	11.4
	Comp. F/D	100.0	11.6	3.32	100.0	100.0
N7	F3C	31.9	6.9	6.69	18.8	63.6
	F3T	3.2	3.5	8.91	0.9	8.5
	Comp. F2C	35.1	6.6	6.89	19.7	72.1
	F2T	12.8	10.9	3.05	11.9	11.6
	Comp. F1C	47.9	7.7	5.86	31.6	83.7
	F1T	52.1	15.4	1.05	68.4	16.3
	Comp. F/D	100.0	11.7	3.36	100.0	100.0
N8	F2C1	24.5	4.6	8.80	9.3	68.9
	F2C2	4.5	6.3	6.06	2.3	8.7
	F2T	11.3	17.4	2.12	16.2	7.7
	Comp. F1C	40.3	8.4	6.62	27.8	85.3
	F1T	59.7	14.7	0.77	72.2	14.7
	Comp. F/D	100.0	12.2	3.13	100.0	100.0

S. The rougher flotation concentrate was refloated to give a sulphide concentrate assaying 2.2% WO₃ and 6.64% S and carrying 69.2% of the sulphur. The cleaner flotation tail assays for WO₃ and S are very similar to the head assay and therefore could be returned to rougher flotation in continuous treatment.

In test N6, in which oxalic acid was used with sulphuric acid, two flotation concentrates were produced. If these concentrates are bulked, we have a sulphide concentrate assaying 7.1% WO₃ and 9.07% S containing 88.6% of the sulphur. The flotation tail assayed 13.7% WO₃ and 0.56% S and contained 80.0% of the WO₃.

In test N7, Vantoc CL was used in cleaner and recleaner flotation of a rougher concentrate which was produced by flotation with no reagents. The recleaner operation proved to be of no benefit.

In test N8, if we bulk the two cleaner concentrates, and bulk the cleaner tail and the rougher tail, we have a sulphide concentrate assaying 4.9% WO₃ and 8.38% S containing 77.6% of the sulphur. The combined flotation tailing assays 15.1% WO₃ and 0.99% S containing 88.4% of the WO₃.

CONCLUSIONS

It is possible to selectively float sulphides from scheelite in the vanner tailing.

The most promising reagents used were Vantoc CL and oxalic acid used in conjunction with sulphuric acid. These reagents warrant further investigation to determine the optimum conditions.

Consideration should be given to removal of sulphides by flotation with xanthates prior to scheelite flotation in the King Island Scheelite mill.

Table 1. SIZING ANALYSIS AND TIN DISTRIBUTION

Fraction	Weight %	Assay % Sn	Sn Distribution %
+25#	0.7	0.19	2.8
25#	3.2	0.14	4.1
50#	8.4	0.18	6.3
75#	12.2	0.19	11.3
100#	17.1	0.21	10.3
125#	14.2	0.27	12.2
150#	13.0	0.23	32.0
175#	9.9	0.40	10.1
200#	7.3	0.34	2.2
225#	4.4	0.23	2.4
250#	2.2	0.12	100.0
275#	0.8		
300#	0.3		
325#	0.7		
350#	4.2		
375#	12.6		
400#	24.8		
425#	41.9		
450#	26.1		
475#	69.1		
500#	79.0		
525#	86.3		
550#	90.7		
575#	92.9		
600#	92.7		
625#	100.0		

Calculated Assay 0.29

The results of the tabling and magnetic separation of the table concentrates at each size fraction from the Geac hydraulic sizer are shown in Table 1.