

TR13_147_152

R. 564**ELECTROLYTIC ZINC CO., BRANCH CREEK
SULPHIDE ORE****FLOTATION OF PYRITE—Part I****Introduction**

A sample of Branch Creek ore, containing finely disseminated pyrite was supplied by the Electrolytic Zinc Company for pyrite concentration tests to see if a concentrate suitable for the manufacture of sulphuric acid could be made.

Object

To concentrate the pyrite by flotation and find the set of conditions which give the highest recovery of sulphur, using the Box-Wilson method of analysis.

Sample

The sample received consisted of about 22 lb of black material which had been crushed to $-\frac{1}{4}$ ". The sample was screened on a 10 mesh screen and the screen oversize was crushed in the laboratory rolls, then re-screened on the 10 mesh screen. This procedure was repeated until all the material passed through the 10 mesh screen.

The sample was thoroughly mixed and cut into 22 samples of 500 gms.

Note:—

- (a) No responsibility will be accepted for the results except insofar as they apply to the sample supplied for test work.
- (b) All screens used were of the British Standard Screen Series.
- (c) Launceston tap water was used throughout the test work.

Test Work

From the analysis of the head sample the following results were obtained:—

- 14.7 per cent total iron.
- 4.1 per cent HCl soluble iron.
- 14.3 per cent sulphur.

That is the ore contained approximately 22.3 per cent pyrite and 6.5 per cent pyrrohotite or approximately 29 per cent of iron sulphides.

Tests N1 to N5 inclusive were concerned only with determining the ball mill grinding time at 60 per cent solids to reduce 500 gms of the -10 mesh ore to (a) 90 per cent passing 100 mesh, (b) 90 per cent passing 200 mesh.

In the subsequent flotation tests, ball mill grinding time was such that it gave either grind (a) or grind (b). Sizing analyses of tests N4 and N5 are shown on tables 1 and 2. It was decided to use levels of soda ash addition as a control rather than two set pH levels since floating at two different pulp densities meant that the different water additions affected the pH, and it would have been very difficult to maintain the two required pH levels.

Tests N6 to N13 were the actual flotation tests with test conditions and reagent additions as shown in table 3. All reagent additions stated are in lb/long ton. The flotation cell used was the Denver D1 Laboratory cell and the agitator speed was kept constant at 1,450 RPM. for all tests. The results of the tests are shown in table 4.

Conclusions

Most tests gave very poor sulphur recoveries. Test N13 gave the best result. In this test 75.4 per cent of the sulphur was recovered in a concentrate assaying 35.3 per cent sulphur.

The Box-Wilson analysis of the results is given on table 5 with the best path indicated.

Test N4

TABLE 1. SIZING ANALYSIS OF BALL MILL DISCHARGE

Fraction	Weight	Per Cent		S	Per Cent Distribution	
		Cum. Weight	Total Fe		Total Fe	S
+ 60 mesh	1.7	1.7	15.0	14.9	9.6	9.8
100 mesh	7.8	9.5				
150 mesh	7.7	17.2	17.4	17.9	9.1	9.6
200 mesh	9.0	26.2	18.0	18.8	10.9	11.8
- 200 mesh ..	73.8	100.0	14.1	13.4	70.4	68.8
Composite ..	100.0	..	14.8	14.4	100.0	100.0

Details: 2 minutes 39 seconds wet grind 60 per cent solids. Wet split on 200 mesh and 100 mesh then dry screened. pH of pulp: 4.1.

Test N5

TABLE 2. SIZING ANALYSIS OF BALL MILL DISCHARGE

Fraction	Weight	Per Cent		S	Per Cent Distribution	
		Cum. Weight	T. Fe		T. Fe	S
+ 60 mesh ..	0.1	0.1	15.3	14.4	1.1	1.0
100 mesh ..	1.0	1.1				
150 mesh ..	2.8	3.9	15.8	15.7	2.9	2.9
200 mesh ..	6.1	10.0	16.3	16.4	6.4	6.6
- 200 mesh ..	90.0	100.0	15.4	15.1	89.6	89.5
Composite ..	100.0	..	15.5	15.2	100.0	100.0

Details: 6 minutes 45 seconds wet grind 60 per cent solids. Wet split on 200 mesh and 100 mesh then dry screened. pH of pulp: 4.7.

Abbreviations used in the tables.

T. Fe Total iron
C Concentrate
T Tailing
F/D Feed

TABLE 3
FLOTATION CONDITIONS

Test No.	pH Control				Density of Pulp before Flotation % Solids	Grind 90% Passing Mesh Stated	Reagent Addition				Time of Flotation
	Addition of Na_2CO_3 lb/ton	pH Readings		Copper Sulphate lb/ton			Isopropyl Xanthate lb/ton	Aero-Depressant 633 lb/ton	Methyl Isobutyl Carbinol lb/ton		
		After Conditioning Before Flotation	At End of Flotation								
N6 ..	..	3.1	2.9	11	100	1.0	0.1	0.5	0.08	10
N7 ..	11.2	5.9	4.7	11	100	..	0.4	0.5	0.08	5	
N8 ..	11.2	6.1	4.6	25	100	1.0	0.1	..	0.08	5	
N9 ..	..	4.1	3.9	25	100	..	0.4	..	0.08	10
N10	..	4.6	4.1	11	200	..	0.1	..	0.08	5	
N11	11.2	6.3	4.1	25	200	..	0.1	0.5	0.08	10	
N12	11.2	6.4	4.3	11	200	1.0	0.4	..	0.08	10	
N13	..	4.4	3.4	25	200	1.0	0.4	0.5	0.08	5	

Tests N6-N13

TABLE 4. FLOTATION TEST RESULTS

<i>Product</i>	<i>Weight (Gms.)</i>	<i>Per Cent</i>			<i>Per Cent Distribution</i>		
		<i>Weight</i>	<i>Total Fe</i>	<i>S</i>	<i>Total Fe</i>	<i>S</i>	
N6	C. ..	45.6	9.7	16.5	15.2	9.9	9.5
	T. ..	424.6	90.3	16.2	15.5	90.1	90.5
	F/D. ..	470.2	100.0	16.2	15.5	100.0	100.0
N7	C. ..	59.5	12.7	26.1	27.7	20.1	22.7
	T. ..	408.1	87.3	15.1	13.7	79.9	77.3
	F/D. ..	467.6	100.0	16.5	15.5	100.0	100.0
N8	C. ..	53.3	11.7	12.5	10.8	9.7	8.6
	T. ..	401.5	88.3	15.4	15.3	90.3	91.4
	F/D. ..	454.8	100.0	15.1	14.8	100.0	100.0
N9	C. ..	174.0	37.7	21.6	23.1	51.5	56.2
	T. ..	287.4	62.3	12.3	10.9	48.5	43.8
	F/D. ..	461.4	100.0	15.8	15.5	100.0	100.0
N10	C. ..	47.3	10.4	15.0	13.0	9.2	8.8
	T. ..	408.1	89.6	17.2	15.7	90.8	91.2
	F/D. ..	455.4	100.0	17.0	15.4	100.0	100.0
N11	C. ..	150.0	32.9	14.0	12.8	28.4	26.6
	T. ..	306.3	67.1	17.3	17.3	71.6	73.4
	F/D. ..	456.3	100.0	16.2	15.8	100.0	100.0
N12	C. ..	125.3	27.4	21.6	22.0	36.8	38.6
	T. ..	332.1	72.6	14.0	13.2	63.2	61.4
	F/D. ..	457.4	100.0	16.0	15.6	100.0	100.0
N13	C. ..	145.4	33.0	32.0	35.3	66.4	75.4
	T. ..	295.0	67.0	7.96	5.66	33.6	24.6
	F/D. ..	440.4	100.0	15.9	15.4	100.0	100.0

TABLE 5
BOX-WILSON ANALYSIS

Factors	..	..	..	A	B	C	D	E	F	G	
Studies	..	..	..	Na ₂ CO ₃	Grind	CuSO ₄	Density	Isopropyl Xanthate	R.633	Flotation Time	
Base level	..	..	..	5.6	105	0.5	18	0.25	0.25	7.5	
Unit	..	..	..	5.6	37.5	0.5	7	0.15	0.25	2.5	
High level	..	..	..	11.2	150	1	25	0.4	0.5	10	<i>H</i>
Low level	..	..	..	0	75	0	11	0.1	0	5	<i>Data</i>
Sample 1. Test N10	..			0	75	0	11	0.1	0	5	8.8
„ 2. „ N7	..			11.2	150	0	11	0.4	0.5	5	22.7
„ 3. „ N12	..			11.2	75	1	11	0.4	0	10	38.6
„ 4. „ N6	..			0	150	1	11	0.1	0.5	10	9.5
„ 5. „ N11	..			11.2	75	0	25	0.1	0.5	10	26.6
„ 6. „ N9	..			0	150	0	25	0.4	0	10	56.2
„ 7. „ N13	..			0	75	1	25	0.4	0.5	5	75.4
„ 8. „ N8	..			11.2	150	1	25	0.1	0	5	8.6
Effect	..	..	..	-6.67	-6.55	2.22	10.90	17.42	2.75	1.92	..
Effect times unit	..	..	..	-37.4	-245.6	1.11	76.3	2.61	0.69	4.80	..
Change	..	..	..	..	..	..	..	..	..	..	..
Best path	..	..	..	-31.8	-140.6	1.61	94.3	2.86	0.94	12.30	..