

TR16-275-279

R.626. Concentration of chromite for Northern Chromite N.L.

Approximately 55 kg of chromite bearing sand was received from the company. The sample was taken from a sluice box which received the under-size from a 40# screen.

ASSAYS

Determination of chromite content of the various metallurgical products was done generally by magnetic separation. In the absence of other magnetic minerals the magnetic fraction (M/A) gives a reasonable approximation of the chromite content of the material, and reduces the quantity of time consuming chemical analyses required. Chemical analyses of some selected products were undertaken.

SIZING ANALYSIS OF THE SAMPLE

After sizing, the sized fractions were magnetically separated to enable assessment of the chromite content of each fraction to be made, and also a size analysis of both the chromite and quartz gangue.

Fraction B.S.S.#	Per Cent Weight			% M/A in each fraction
	F/D	M/A	N	
+25	Trace	Trace	Trace	
+52	2.7	3.2	2.2	58
+100	34.7	47.7	22.2	67
+200	35.2	33.7	36.6	47
+300	10.1	7.2	12.8	35
-300	17.3	8.2	26.2	23
Head	100.0	100.0	100.0	49

TREATMENT METHODS INVESTIGATED

Concentration by Hydraulic Cyclone

This treatment was suggested as a possible inexpensive method of concentration of the chromite. A test, using a 3 inch Warman cyclone, showed this proposal to be impracticable. The method involved desliming by hydraulic cyclone followed by the recyloning of the first underflow in an attempt to produce a chromite concentrate in the second underflow.

Results

1st Cycloning

Product	% Weight	% M/A	% M/A Distn
O/F (slime)	2.8		
U/F	97.2		

2nd Cycloning

Product	% Weight	% M/A	% M/A Distn
O/F	81.2	40	77.7
U/F	16.0	58	22.3

The test gave a recovery of 22.3% in a concentrate containing 58% chromite (about 35% Cr<sub>2</sub>O<sub>3</sub>).

Table 1. TEST CONDITIONS

Test No. and Stage	O.A.	F.O.	Reagents (lb/ton)								Time (minutes)		
			710	824	SCS	3035	Armac	Calgon	HF	Na <sub>2</sub> SiF <sub>6</sub>	Cond.	Flot.	
N2 F1	2.5											5	3
F2		0.1		0.5								nil	3
N3 F1		0.5	1.0	0.5							2	5	5
F2		0.5	0.5	0.5								nil	5
N7 F1		3.0			1.0						2	5	5
F2		0.5			1.0							nil	2
N8 F1		4.0		1.5								3	5
F2		0.5		0.5							2	nil	2
N9		3.0					1					3	3
N12		3.0						1	1	1		5	3

In all the above tests pH was adjusted to between 3 and 4 with sulphuric acid, usage being about 0.5 lb/ton.

Explanation of abbreviations used for reagents:

O.A.	oleic acid	3035	Cyanamid Aeromine 3035 (undefined amine)
F.O.	fuel oil	Armac	Armac C (thought to be coco-amine acetate)
710	Cyanamid Reagent 710 (sodium soap of crude fatty acid)	Calgon	Sodium hexametaphosphate - dispersing agent
824	Cyanamid Reagent 824 (anionic sulphate type promotor)	HF	hydrofluoric acid - quartz depressant
SCS	sodium cetyl sulphate	Na <sub>2</sub> SiF <sub>6</sub>	sodium silicofluoride - quartz depressant

Test Results Magnetic 'Assays'

Test No. and Product	% Weight	% M/A	% M/A Distn
N2 FC1	21.7	96	47.6
FC2	19.1	52	22.7
FT	59.2	22	29.7
Head	100.0	44	100.0
N3 FC1	36.2	87	69.5
FC2	11.3	81	20.2
FT	52.5	9	10.3
Head	100.0	45	100.0
N7 FC1	42.7	63	55.8
FC2	13.2	64	17.6
FT	44.1	29	26.6
Head	100.0	48	100.0

Chemical Cr<sub>2</sub>O<sub>3</sub> Determination

Test No. and Product	% Weight	% Cr <sub>2</sub> O <sub>3</sub>	% Cr <sub>2</sub> O <sub>3</sub> Distn
N8 FC1	36.1	53.1	66.3
FC2	22.7	28.9	22.7
FT	41.2	0.77	11.0
F/D	100.0	28.9	100.0
N9 FC	47.1	53.4	96.0
FT	52.9	1.96	4.0
F/D	100.0	26.2	100.0
N12 FC	48.0	52.7	94.8
FT	52.0	2.67	5.2
F/D	100.0	100.0	100.0

Discussion

Some very encouraging results have been obtained in the above flotation tests using fuel oil in combination with various other promoters.

For example Test N9 has given a chromite concentrate containing 53.4% Cr<sub>2</sub>O<sub>3</sub> with a recovery of 96%. This result is quite comparable to that obtained by sizing and table concentration.

There appears to be no valid reason why similar results could not be achieved in commercial practice.

SUMMARY

The experimental work on this sample has shown that:

- (1) The use of hydraulic cyclones as concentrating devices is not feasible.
- (2) High recoveries of high grade chromite concentrates can be achieved by sizing followed by table concentration.
- (3) Under suitable conditions, froth flotation techniques can produce results comparable with gravity concentration.

The sample was then well mixed and divided to provide a head sample for assay purposes and a large sample from which tail samples could be cut. Leaching tests were conducted by leaching 500 g of sample and collecting the sample with the same weight of acid solution in 2.5 liter acid resistant bottles rolling on rubber rollers for definite time periods.

In tests W1 and W2, the sulphuric acid strength was 10%. After the first two tests, the results indicated that more copper was being dissolved than could be accounted for by the acid concentration. Accordingly a test was conducted in which a quantity of water was used of equal volume to the acid solutions in the first two tests.

In tests W3, W4, W5, and W6, the sulphuric acid strengths were 20, 15%, and 5% respectively.

The conditions used in the leaching tests are shown together with the results of the tests in the table.

The head sample assayed 3.3% copper.

Test Conditions and Results

Test No.	Acid Strength Weight %	Agitation Time (minutes)	Residue Assay % Cu	Head Assay (calculated) % Cu	Cu Recovery in solution %	Acid Consumption l/bbl of ore
W1	10	30	0.38	1.58	97.8	90.9
W2	10	60	0.23	1.41	97.9	90.8
W3	water	45	2.8	1.27	10.7	-
W4	5	60	0.37	1.22	97.7	76.6
W5	15	60	0.27	1.40	92.7	100.3
W6	2	120	0.06	1.14	98.2	78.0

TEST RESULTS

These results show that 16.7% of the copper is present in a water-soluble form.

Good recovery of copper can be obtained by agitation in dilute sulphuric acid. About 90% of the copper can be recovered by agitating the ore for half an hour in 10% sulphuric acid or by agitating for twice as long with half strength (5%) sulphuric acid. Acid consumption is reduced appreciably when using the weaker acid solution. Better recoveries were obtained with 10% sulphuric acid and 15% sulphuric acid with one hour's agitation. However, acid consumption increases as the strength of acid is increased. By