TR18_207-211

R.668 Further recovery tests on Razorback oxidised ore, Dundas.

K.J. Austin
H.K. Wellington

During cassiterite recovery tests for Minops Pty Ltd (Investigation R.653) it was seen that the nature of the ore was such that a suitable attrition and cycloning operation could possibly dispose of 50% of the mass, without loss of recoverable tin. This report extends the work of Investigation R.653 and investigates the rejection of fine slime material.

SAMPLE

The samples used were as follows:

(1) Test N1 - Investigation R.653, N4 S5 F/D (Primary -600 µm)
(2) Test N2 - Investigation R.653, N4 S5 F/D combined in the natural proportions of 64 to 36 by weight.

METHODS

Test N1

Primary -600 µm material was agitated in a 24 cm diameter x 60 cm Denver conditioner with the following conditions.

	Agitation time (min.)	*% Solids (W/W)*
Run 1	30	23.4
Run 2	60	28.8
Run 3	60	9.0

The pulp was continuously pumped by a centrifugal pump during the whole of the agitation period. After the agitation period had elapsed, the pulp was fed to a cyclone fitted with a 6.4 mm diameter spigot and a 12.5 mm diameter overflow.

Test N2

(1) A feed sample was cut out, sized and a tin distribution obtained.
(2) The -600 µm material was agitated for 30 minutes at 18% solids and then cycloned (C1). Agitation and cyclone conditions were the same as in Test N1.
(3) Cyclone overflow (C1O/F) material was settled, dried and weighed.
(4) Cyclone underflow (C1U/F) material was fed to a Geco classifier (C2). The rising current velocity of each spigot was as follows:

No. 1 spigot	7.17 mm/s	C2S1
No. 2 spigot	5.15 mm/s	C2S2
No. 3 spigot	2.00 mm/s	C2S3

(5) The three spigot products plus the classifier overflow were separately concentrated on a Deister table (T1 etc).
(6) The table concentrates were magnetically separated on a Rapid high intensity dry magnetic separator. (M/S1 etc)

RESULTS

The results of Test N1 and N2 are given in Tables 1 - 5.

Table 1. TEST N1. SLIME REJECTION BY HYDRAULIC CYCLONE TESTS

Run On	% Solids	Agitation time (min.)	Fraction	% Mass	% Sn	% Sn Distn	Individual fraction % Mass <C/S2	Individual fraction % Sn Distn <C/S2
1	-	-	O/F	51.9	0.14	11.0	99.0	96.3
	-	-	U/F	48.1	1.14	89.0	30.2	9.0
	23.4	30	Head	100.0	(0.66)	100.0	-	-
2	-	-	O/F	58.8	0.16	16.1	98.0	94.2
	-	-	U/F	41.2	1.19	83.9	26.7	9.1
	28.8	60	Head	100.0	(0.58)	100.0	-	-
3	-	-	O/F	46.8	0.13	9.9	99.3	97.9
	-	-	U/F	53.2	1.04	90.1	39.9	10.7
	9.0	60	Head	100.0	(0.61)	100.0	-	-

Table 2. TEST N1. COMPARISON OF MASS DISTRIBUTION

Fraction µm	PERCENT MASS Run 1 U/F	Run 1 O/F	Run 1 H	Run 2 U/F	Run 2 O/F	Run 2 H	Run 3 U/F	Run 3 O/F	Run 3 H	F/D
-600 +300	0.1	-	0.1	Tr	-	Tr	Tr	-	Tr	Tr
-300 +150	0.8	-	0.8	0.7	Tr	0.7	0.7	Tr	0.7	0.6
-150 +75	15.4	0.1	15.5	14.0	0.1	14.1	14.2	0.1	14.3	15.6
-75 +38	15.3	0.4	15.7	13.5	0.8	14.3	14.9	0.2	15.1	17.1
C/S1 *	0.4	Tr	0.4	0.5	Tr	0.5	0.3	Tr	0.3	0.2
C/S2	1.6	0.1	1.7	1.5	0.3	1.8	1.9	0.1	2.0	1.0
C/S3	5.5	0.8	6.3	3.7	2.7	6.4	6.1	0.4	6.5	5.5
C/S4	3.1	4.2	7.3	1.9	6.4	8.3	5.5	2.6	8.1	8.5
C/S5	0.9	3.6	4.5	0.7	4.3	5.0	1.7	3.3	5.0	5.2
O/F	5.0	42.7	47.7	4.7	44.2	48.9	7.9	40.1	48.0	46.3
Head	48.1	51.9	100.0	41.2	58.8	100.0	53.2	46.8	100.0	100.0

Note: U/F + O/F = H * Cyclosizing at 9°C.

Table 3. TEST N2. SIZING ANALYSIS OF FEED SAMPLE.

Fraction (μm)	*% Mass*	*% Sn*	*% Sn Distn*	*% Sn cum. Distn*
-600 +300	0.04)	0.78	1.6	1.6
-300 +150	1.24)			
-150 +75	19.96	0.98	30.6	32.2
-75 +38	18.17	1.00	28.4	60.6
C/S1*	0.24	28.3	10.6	71.2
C/S2	1.44	2.45	5.5	76.7
C/S3	6.43	0.59	5.9	82.6
C/S4	8.23	0.38	4.9	87.5
C/S5	5.01	0.31	2.4	89.9
O/F	39.24	(0.17)	10.1	100.0
Head	100.0	0.64	100.0	-

* Cyclosizing at 9°C

Table 4. TEST N2. CONCENTRATION RESULTS.

Fraction	*% Mass*	*% Sn*	*% Sn Distn*
M/S1 N	0.38	64.9	40.0
M/S1 M/A1	0.24	0.19	0.1
M/S1 M/A2	0.79	0.34	0.4
T1C	1.41	(17.7)	40.5
T1M	0.83	0.61	0.8
T1T	8.57	0.21	2.9
C2S1	10.81	(2.52)	44.2
M/S2 N	0.12	67.2	13.0
M/S2 M/A1	0.25	0.10	0.1
M/S2 M/A2	0.29	0.66	0.3
T2C	0.66	(12.5)	13.4
T2M	1.16	0.40	0.8
T2T	9.54	0.14	2.1
C2S2	11.36	(0.88)	16.3

Fraction	% Mass	% Sn	% Sn Distn
M/S3 N	0.10	68.1	11.0
M/S3 M/A1	0.23	0.18	0.1
M/S3 M/A2	0.39	1.30	0.8
T3C	0.72	(10.2)	11.9
T3M	0.97	0.35	0.6
T3T	9.28	0.12	1.8
C2S3	10.97	(0.80)	14.3
M/S4 N	0.07	51.8	5.9
M/S4 M/A1	1.25	1.68*	3.4
M/S4 M/A2	0.22	8.86*	3.1
T4C	1.54	(4.98)	12.4
T4M	3.44	0.16	0.9
T4T	21.57	0.08	2.8
C2 O/F	26.55	(0.37)	16.1
C1 U/F	59.69	(0.94)	90.9
C1 O/F	40.31	0.14	9.1
Head	100.00	(0.62)	100.0

* Poor dry magnetic separation was due to the very fine size of the classifier overflow table concentrate product. No suitable wet magnetic separation was available for the small quantity of material in these fractions. Composite magnetic figures are later swamped by the tin content of these fractions.

Table 4. TEST N2. SUMMARY OF CONCENTRATION RESULTS.

Fraction	% Mass	% Sn	% Sn Distn
M/S N	0.67	(64.4)	69.9
M/S M/A1	1.97	(1.12)	3.7
M/S M/A2	1.69	(1.73)	4.6
TC	4.33	(11.2)	78.2
TM	6.40	(0.29)	3.1
TT	48.96	(0.12)	9.6
C1 U/F	59.69	(0.94)	90.9
C1 O/F	40.31	0.14	9.1
Head	100.00	(0.62)	100.0

Table 5. TEST N2. Cl O/F SIZING ANALYSIS

Fraction (μm)	*% Mass*	*% Sn*	*% Sn Distn*	*% Sn cum. Distn*
-150 +75	0.05	0.26	0.9	0.9
-75 +38	0.45			
C/S1	0.05	1.72	1.8	2.7
C/S2	0.10			
C/S3	0.90	0.41	2.6	5.3
C/S4	3.95	0.29	8.2	13.5
C/S5	7.65	0.25	13.7	27.2
O/F	86.85	(0.12)	72.8	100.0
Head	100.00	0.14	100.0	-

* Cyclosizing at 8°C

From the cyclone overflow sizing analysis it can be seen that 86.85% of the material removed by cycloning was less than C/S5 in size, and also that 94.7% of the tin removed in the cyclone overflow was finer than C/S2.

CONCLUSION

Attrition in the Denver conditioner has produced only a very small change in the sizing analysis of the original material. The heavily oxidized ore was previously thought to be very amenable to a size reduction process such as high intensity scrubbing or attrition.

The use of a cyclone to remove slime material has increased the tin head value considerably without significant loss of recoverable tin. In concentration Test N2, 40% of the original weight was removed as cyclone overflow, with a loss of 9.1% of the original tin. Of the tin loss 8.6% was -13 μm material.

In comparing concentration Test N2 with Investigation R.653, Test N4, the benefit of slime removal prior to gravity concentration can be readily seen.

Test	*Sample*	*Feed Size (μm)*	*% Mass*	*% Sn*	*% Recovery*
R.668 N2	B	-590	0.67	64.4	59.9
R.653 N4	B	-590	0.70	53.7	55.1

The samples used in these attrition tests were the products of autogenous grinding from Investigation R.653 and had therefore undergone a grinding process prior to attrition. Attrition comparisons of feed and products were based on wet screen analysis which in itself causes degradation of loosely bound particles. Dry screening of the feed is not practical because of the inefficiencies due to clogging of the screens in the finer sizes. If it were possible to get an accurate dry screen analysis, then the actual effect of attritioning on the ore could be indicated.

[30 October 1973]