TR6-209-214

R. 380

RENISON ASSOCIATED TIN MINES, N.L. TIN ORE

Samples

Samples of products from treatment of tin ore from Renison Bell (R.B. 6) stated to contain 0.82% of tin were roasted on a fluidized bed under oxidizing conditions by the chemical engineering section of C.S.I.R.O., Melbourne, and samples of products from this treatment and magnetic separation were submitted for concentration of the cassiterite.

The products were labelled "magnetic" and "non-magnetic", and were assayed with the following results.

Percent	Non-Magnetics	Magnetics
Tin, total	3.5	0.24
Tin, by vanning assay	3.03	0.06
Sulphur	5.78	9.1
Weight of sample	970 grams	2950 grams

It has been estimated that the magnetics represent 76% of the treated ore, and without allowance for treatment loss, the cassiterite head sample would be:—

Product	Percent Weight	Percent Tin	Tin Distribution Percent
Magnetics	76	0.24	17.8
Non-Magnetics	24	3.5	82.2
Composite	100	1.02	100

Investigation

Samples were examined for concentration of the cassiterite, and as the vanning assay of the "magnetics" was only 0.06% tin the investigations reported herein are mainly related to the examination of the "non-magnetic" sample.

Summary

"Non-Magnetic Fraction"

1. Concentration tests indicate recoveries of cassiterite of 64 to 66% in concentrates of 63 to 67% tin, and increased recovery to 74%, with a drop in concentrate grade to 56% tin.

2. Solution of some of the gangue minerals with aqua regia and concentration resulted in a recovery of 86%, with a concentrate of 73% tin.

3. Treatment with sulphuric acid and sulphuric acid and salt resulted in recoveries of 78 and 87% in concentrates containing 68 and 70% of tin. Mineragraphic examinations have not been made. However, the higher recoveries obtained, after acid digestion, indicate a release of composites of cassiterite, or better concentration due to the solution of heavy gangue.

4. Sizing analysis shows enrichment of tin contents in fractions finer than 100 mesh, and this may be caused by the fluosolids roasting. Absence of fines is notable.

5. Treatment of the sample in a high intensity electro-magnetic separation showed the total sample to be magnetic, but no useful separation was obtained.

"Non-Magnetics"

Assays

3.5% tin
5.78% total sulphur
5.11% sulphur as sulphide
0.67% sulphur as sulphate

Infrasizer Analysis

Fraction	Percent Weight	Percent Sn	Percent Distribution Sn
+ 60 mesh	12.5	1.16	3.9
+ 85 mesh	15.9	1.45	6.2
+ 100 mesh	6.9	1.83	3.4
+ 120 mesh	9.7	2.51	6.6
+ 150 mesh	8.4	3.33	7.6
+ 200 mesh	10.8	4.52	13.2
Infrasizer 1	6.1	16.7	27.4
Infrasizer 2	10.9	5.82	17.1
Infrasizer 3	8.4	3.69	8.4
Infrasizer 4	5.3	2.91	4.2
Infrasizer 5	2.7 } 3.4	1.85	1.7
Infrasizer 6	0.7 }	....	....
Infrasizer 7	1.7	0.59	0.3
Composite	100.0	3.70	100.0

The various fractions from the sizing were then acid treated and a high grade tin concentrate separated by the "Tin Vanning Assay" method. Infrasizer fraction 7 was not so treated due to the small quantity available.

Fraction	Vanned Concentrate Percent Weight	Sn	Percent Tin Recovery In Fraction	Overall
+ 60 mesh	0.074	67.2	34.3	1.3
+ 85 mesh	0.152	69.1	45.6	2.8
+ 100 mesh	0.144	68.9	78.6	2.7
+ 120 mesh	0.272	71.0	79.3	5.2
+ 150 mesh	0.301	72.4	77.9	5.9
+ 200 mesh	0.535	74.5	81.7	10.8
Infrasizer 1	1.211	76.7	91.2	25.1
Infrasizer 2	0.753	75.9	90.3	15.5
Infrasizer 3	0.376	75.1	91.2	7.6
Infrasizer 4	0.158	74.7	76.6	3.2
Infrasizer 5	0.037	70.4	41.4	0.7
Infrasizer 6				
Infrasizer 7	....	....	....	....
Composite	4.013	74.5	80.8	80.8

It will be noted that the tin content of the coarsest fractions is appreciably less than that of the whole sample. The proportion of tin recovered by vanning from these fractions is comparatively low. This low recovery is partly due to the low initial tin content of the fractions. It appears possible that the material say plus 85 or plus 100 mesh may be rather too coarse to have received maximum benefit from the earlier roasting and magnetic separation treatment.

The sample contained comparatively little true fines, and the indicated tin loss is consequently quite small. Some losses of fines may have occurred during roasting or magnetic separation.

Examination of the Sample

A sample of the "non-magnetics" was treated by the standard "Tin Vanning Assay" method.

Product	Percent Weight	Sn	Percent Distribution Sn
Vanning Concentrate	4.14	73.1	86
Head Sample	100.0	3.5	100

Several samples were concentrated by panning, without any chemical treatment of the sample. The recovery of tin in the concentrates varies somewhat, depending upon the technique employed.

A. Primary concentrate obtained by panning sample three times; secondary concentrate obtained by grinding tailings in a mortar and panning ground product to a total of three cycles.

B. Sample panned and tailings ground; ground material re-panned and tailings ground to a total of six cycles. Pannings were all aimed at obtaining maximum recovery of tin in a low grade concentrate.

Low grade concentrate re-panned to give a higher grade concentrate and tailings 2.

Higher grade concentrate re-panned to eliminate majority of lighter materials as a " middling ".

Concentrate re-panned to give a high grade " concentrate 1 ", and a lower grade " concentrate 2 ".

Product	Percent		Percent Distribution
	Weight	Sn	Sn
A.			
Primary panning conc.	2.58	70.0	52
Secondary panning conc.	0.69	58.7	11
Total conc.	3.27	67.6	63
Head	100	3.5	100
B.			
Concentrate 1	3.57	63.1	65.9
Concentrate 2	0.80	26.0	6.1
Middlings	0.63	8.18	1.5
Tailings 2	8.33	2.23	5.4
Tailings 1	86.67	0.83	21.1
	100.00	3.4	100.0
Combined conc. 1 and 2	4.37	56.3	72.0

There is quite a difference between the recoveries obtained by panning, as against the recovery obtained by " vanning " the sample. A feature of " vanning " is the quantity of free tin readily separated from the tailings. With panning, without prior chemical treatment of the sample, the quantity of readily separated free tin appears appreciably less, and it appears to be more difficult to concentrate. This is partly due to the presence of heavy gangue minerals.

The original " vanning " assay involves decomposition of part of the sample with hydrochloric and nitric acids. Tests were made to determine if similar results could be obtained using (*a*) sulphuric acid (*b*) sulphuric acid and salt. Salt used was approximately 30% by weight of sample, but there is no reason to consider that this quantity was actually required or consumed.

The sample was slowly heated with 30% sulphuric acid until fuming, and fuming continued for about half an hour.

Two concentrates were obtained from each sample:—

(1) Primary concentrate obtained from three successive pannings without grinding.

(2) Secondary concentrate obtained from three successive grinding and panning steps.

Product	Weight	Percent Sn	Percent Distribution Sn
(*a*) *Sulphuric Acid Digestion*			
Primary conc.	3.2	71.4	65
Secondary conc.	0.8	55.9	13
Total conc.	4.0	68.3	78
Head	100.0	3.5	100
(*b*) *Sulphuric Acid-Salt Digestion*			
Primary conc.	3.9	72.4	81
Secondary conc.	0.4	54.1	6
Total conc.	4.3	70.7	87
Head	100.0	3.5	100

Magnetic Separation

The "non-magnetics" designation of the sample is merely relative, as almost the entire sample can be removed as magnetic products by a high intensity Rapid magnetic separator.

A sample of the "non-magnetics" was treated in the Rapid magnetic separator.

Front disc raised 3/16 inch. Amperage front magnet 0.2 amps. (minimum possible). Second disc raised 1/16-3/32 inch. Amperage second magnet 0.5 amps. (maximum possible).

Separation procedure was:—

(1) Whole sample put through separator.
(2) Products 3 and 4 and non-magnetics removed and bulked as "1st non-magnetics".
(3) Product 2 retreated.
(4) Product 1 retreated.
(5) Product 1 removed.
(6) Product 2 retreated.
(7) Product 1 retreated.
(8) Product 1 bulked with 5 above as "1st magnetics".
(9) Product 2 removed as "2nd magnetics".
(10) Product 3, 4 and non-magnetics removed as "2nd non-magnetics".

Product 1 ("1st magnetics") is comparatively strongly magnetic, and will move along the belt from 1-1½ inches from the front of the disc.

Product	Percent		Percent Distribution
	Weight	Sn	Sn
1st Magnetics	71.6	2.47	49.7
2nd Magnetics	22.0	4.78	29.6
2nd Non-Magnetics	4.9	11.95	16.5
1st Non-Magnetics	1.5	10.04	4.2
Composite	100.0	3.56	100.0

" Magnetics "

Brief examination only was made of the " magnetics " sample received.

A standard vanning test gave—

Product	Percent		Percent Distribution
	Weight	Sn	Sn
Vanning conc.	0.12	52.6	26
Head sample	100.0	0.24	100