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RELO GRINDING BODIES

COMPARATIVE BOND TEST REPORT

June 2019



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COMPARATIVE BOND TEST REPORT

June 2019

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1 INTRODUCTION

Wardell Armstrong International (WAI) was commissioned by RELO Grinding Bodies (RELO) to undertake comparative Bond testing on a single sample of ore to determine the difference in energy requirement when undertaking grinding using RELO grinding bodies compared with standard spherical grinding media.

The RELO grinding bodies are tetrahedral in shape and are reported to require less energy to achieve the same level of grinding as standard spherical media. Photographs of the two media types are shown below in Photo 1.1 and Photo 1.2.



Photo 1.1: RELO Grinding Bodies



Photo 1.2: Spherical Grinding Media

2 TEST RESULTS

Testing was performed using the standard Bond Ball Mill test methodology on a single blended sample or ore crushed to a feed size of 100% passing 3.35mm.

A summary of the media specifications used for each test is given below in Table 2.1.

Table 2.1: Grinding Media Specifications					
Spherical Grinding Media			RELO Grinding Bodies		
Nominal Ball Size (mm)	Number of Balls	Total Mass (g)	Nominal Body Size (mm)	Number of Bodies	Total Mass (g)
38.1	25	5,566	36.8	43	9,077
31.8	39	5,001	29.7	67	8,181
25.4	62	4,056	25.4	10	622
22.2	69	3,004	19.1	71	1,855
19.1	90	2,493	15.5	94	1,391
Total	285	20,120	Total	285	21,126

The results of the tests are summarised below in Table 2.2. Full results are given in Appendix 1.

Table 2.2: Bond Ball Mill Test Results		
	Spherical Grinding Media	RELO Grinding Bodies
100% Passing Size of Feed (µm)	3,350	3,350
80% Passing Size of Feed (µm)	2,526	2,526
100% Passing Size of Product (µm)	106	106
80% Passing Size of Product (µm)	80	80
Grams Undersize per Revolution	0.99	1.14
Bond Ball Mill Work Index (kWhr/tonne)	18.34	17.17

The results showed the spherical grinding media to require 18.34kWhr/t of energy to grind the sample compared with an energy requirement of 17.17kWhr/t for the RELO Grinding Bodies, a difference of 6.4%.

APPENDIX 1: Bond Test Reports

Bond Ball Mill Work Index Test

Client: RELO
Project: ZT64-0692
Media: Standard BWi Charge

Date: 19/02/2019
Operator: Dom

Weight of Feed (700ml):	1,497.2g
Closing Screen Size:	106 µm
Undersize in Feed:	7.4%
Target Weight of Product:	427.8g

Nominal Ball Size (mm)	Number of Balls	Total Weight (g)
38.1	25	5,566
31.8	39	5,001
25.4	62	4,056
22.2	69	3,004
19.1	90	2,493
	285	20,120

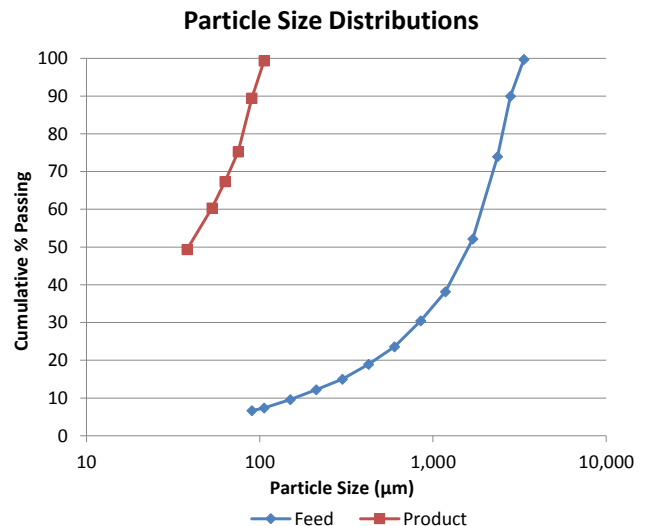
Cycle	New Feed (g)	Undersize (g)	Oversize (g)	Revolutions	Undersize in Feed (g)	Net U/S (g)	Net U/S per Rev	Revs for Next Cycle	Circulating Load
1	1,497.2	206.7	1,290.2	100	110.2	96.5	0.96	428	624.3
2	207.0	390.1	1,103.9	428	15.2	374.9	0.88	456	283.8
3	393.3	460.1	1,037.0	456	29.0	431.1	0.95	417	225.4
4	460.2	442.5	1,053.2	417	33.9	408.6	0.98	403	238.4
5	444.0	432.6	1,061.9	403	32.7	399.9	0.99	399	246.1
6	435.3	430.1	1,064.8	399	32.0	398.1	1.00	397	248.1

$$BWI = \frac{44.5}{P1^{0.23} \times Grp^{0.82} \times \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right)}$$

P1 = 100% passing size of Product 106 µm
 Grp = Grams per revolution 0.99
 F₈₀ = 80% passing size of Feed 2,526 µm
 P₈₀ = 80% passing size of Product 80 µm

Bond Ball Mill Work Index: 18.34 kWhr/tonne

Feed					Product				
Size µm	Weight (g)	(%)	(Σ%)	Σ % Passing	Size µm	Weight (g)	(%)	(Σ%)	Σ % Passing
3,350	3.8	0.25	0.25	99.75	106	2.7	0.6	0.64	99.36
2,800	145.6	9.73	9.98	90.02	90	42.1	9.9	10.50	89.50
2,360	240.6	16.07	26.05	73.95	75	61.0	14.3	24.78	75.22
1,700	326.6	21.81	47.86	52.14	63	33.5	7.85	32.63	67.37
1,180	209.7	14.01	61.87	38.13	53	30.1	7.04	39.67	60.33
850	115.4	7.71	69.58	30.42	38	47.1	11.02	50.68	49.32
600	102.7	6.86	76.43	23.57	-38	210.7	49.32	100.00	0.00
425	69.6	4.65	81.08	18.92					
300	58.5	3.90	84.99	15.01					
212	42.5	2.84	87.82	12.18					
150	39.2	2.62	90.44	9.56					
106	32.9	2.20	92.64	7.36					
90	10.7	0.71	93.35	6.65					
-90	99.5	6.65	100.00	0.00					
Total	1497.2	100.00			Total	427.1	100.00		
d80			2,526 µm		d80			80 µm	



Bond Ball Mill Work Index Test

Client: RELO
Project: ZT64-0692
Media: RELO Charge

Date: 18/02/2019
Operator: Dom

Weight of Feed (700ml):	1,497.2g
Closing Screen Size:	106 µm
Undersize in Feed:	7.4%
Target Weight of Product:	427.8g

Nominal Ball Size (mm)	Number of Balls	Total Weight (g)
36.8	43	9,077
29.7	67	8,181
25.4	10	622
19.1	71	1,855
15.5	94	1,391
	285	21,126

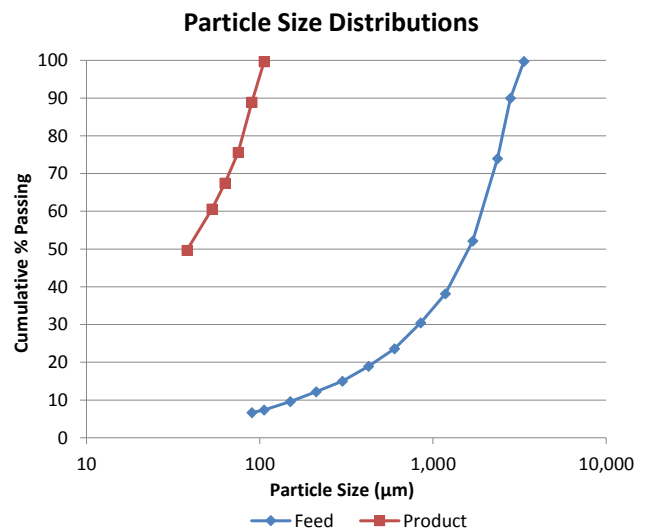
Cycle	New Feed (g)	Undersize (g)	Oversize (g)	Revolutions	Undersize in Feed (g)	Net U/S (g)	Net U/S per Rev	Revs for Next Cycle	Circulating Load
1	1,497.2	215.0	1,282.1	100	110.2	104.8	1.05	393	596.4
2	215.1	407.2	1,089.8	393	15.8	391.4	1.00	399	267.7
3	407.4	440.4	1,056.0	399	30.0	410.4	1.03	384	240.0
4	441.2	470.5	1,026.5	384	32.5	438.0	1.14	345	218.2
5	470.7	428.6	1,065.6	345	34.6	394.0	1.14	347	249.3
6	431.6	427.0	1,059.6	347	31.8	395.2	1.14	348	250.6

$$BWI = \frac{46.6}{P1^{0.23} \times Grp^{0.82} \times \left(\frac{10}{\sqrt{P}} - \frac{10}{\sqrt{F}} \right)}$$

P1 = 100% passing size of Product 106 µm
 Grp = Grams per revolution 1.14
 F₈₀ = 80% passing size of Feed 2,526 µm
 P₈₀ = 80% passing size of Product 80 µm

Bond Ball Mill Work Index: 17.17 kWhr/tonne

Feed					Product				
Size µm	Weight (g)	(%)	(Σ%)	Σ % Passing	Size µm	Weight (g)	(%)	(Σ%)	Σ % Passing
3,350	3.8	0.25	0.25	99.75	106	1.4	0.3	0.33	99.67
2,800	145.6	9.73	9.98	90.02	90	45.6	10.7	11.07	88.93
2,360	240.6	16.07	26.05	73.95	75	56.7	13.3	24.41	75.59
1,700	326.6	21.81	47.86	52.14	63	34.5	8.12	32.53	67.47
1,180	209.7	14.01	61.87	38.13	53	29.2	6.88	39.41	60.59
850	115.4	7.71	69.58	30.42	38	46.3	10.90	50.31	49.69
600	102.7	6.86	76.43	23.57	-38	211.0	49.69	100.00	0.00
425	69.6	4.65	81.08	18.92					
300	58.5	3.90	84.99	15.01					
212	42.5	2.84	87.82	12.18					
150	39.2	2.62	90.44	9.56					
106	32.9	2.20	92.64	7.36					
90	10.7	0.71	93.35	6.65					
-90	99.5	6.65	100.00	0.00					
Total	1497.2	100.00			Total	424.6	100.00		
d80	2,526 µm				d80	80 µm			



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