MINPRO

REPORT Ao 7028
Date
2010-03-05

MP, JA, BZ

Beowulf Mining

ORE DRESSING TESTS WITH MAGNETITE FROM THE "KALLAK" DEPOSIT

MINPRO

Date
2010-03-05

MP, JA, BZ

Beowulf Mining

At the request of Beowulf Mining, J-O Larsson some initial tests has been carried out concerning concentration of a magnetite ore from the Kallak deposit.

The main purpose has been to investigate the possibilities of producing a saleable product such as a <u>sinter feed</u> and preferably a high grade <u>pellet feed</u>.

The test work has been carried out in bench scale.

TESTPROGRAMME

- Dry magnetic separation.

- Wet magnetic separation.

- Magnetic separation followed by quarts flotation.

TESTMATERIAL

About 18 kg ¼" drill cores were delivered to Minpro in December 2009.

Chemical analyses see App. 1.

The drill cores were crushed to < 5 mm before further work.

TESTPERFORMANCE

See appendices for each test.

RESULTS

The test results are presented in appendices below followed by short comments.

Appendices:

App. 1 Chemical analyses of drill core sample
App. 2 Dry magnetic separation, 3 steps
App. 3 Magnetic separation on Dings Davis Tube, 3 ore sizes
App. 4 Magnetic separation followed by quarts flotation
App. 5 Magnetic separation of floated ore on Dings Davis Tube

COMMENTS

The Kallak-ore is a fine grained type of ore. That is confirmed by the results from dry magnetic separation tests (App. 2). The drill core feed has been concentrated from a Fe-concentrate of 41,5 % to Fe = 47,1 % after a 3-step separation, while a total non-magnetic fraction with Fe = 31,0 % was achieved. Our opinion is that such a way for acceptable concentration of the ore is not practable.

However, a traditional treatment by fine grinding and wet magnetic separation seems to give an acceptable product Fe = 68 % corresponding to a recovery of 85,1 %. Even a better result has been achieved by flotation of the magnetic fraction. The Fe-content has been increased up to 69,2 %, low in P_2O_5 0,03 %, low S-content 0,011 % and a SiO_2-content of 2,48 %.

A further improvement can be achieved if the flow sheet is completed with a wet-magnetic separation.

As can be seen in App. 5 a high grade magnetite could be produced with a chemical composition as below:

Fe = 70,4 %
SiO_2 = 1,5 %
Na_2O = 0,007 %
H_2O = 0,015 %
MnO = 0,002 %
P_2O_5 = 0,03 %
TiO_2 = 0,02 %
S = 0,01 %

Stråssa March 5, 2010

Johan Arvidsson

Bo Zander

CONCENTRATION TESTS WITH MAGNETITE FROM "KALLAK-DEPOSIT"

App. 1

Chemical analyses of drill core sample

Anal.	%
Fe	39,8
SiO_2	33,1
MnO	0,57
P_2O_5	0,090
TiO_2	0,10
S	0,007

CONCENTRATION TESTS WITH MAGNETITE FROM "KALLAK-DEPOSIT"

App. 2

Test 1 Dry magnetic separation in three steps on feed crushed to minus 5 mm.

Result

Drum speed r.p.m	Products	Weight %	Fe -%	
			Assay	Distrib.
75	Magnetic 1 = to step 2	93,3	41,5	97,2
	Non-magnetic 1	6,7	16,8	2,8
150	Macnetic 2 = to step 3	83,1	43,8	91,2
	Non-magnetic 2	10,2	23,5	6,0
	Non-magnetic 1-2	16,9	20,9	8,8
225	Macnetic 3 [1)]	55,1	47,1	65,1
	Non-magnetic 3	28,0	37,2	26,1
	Non-magnetic 1-3	44,9	31,0	34,9
	Feed Calc	100,0	39,9	100,0
	Anal		39,8	

[1)] 29,0 % SiO_2, 0,66 % MnO, 0,088 P_2O_5, 0,11 % TiO_2, 0,06 % S

CONCENTRATION TESTS WITH MAGNETITE FROM "KALLAK-DEPOSIT"

Test 2A-C Magnetic separation on Davis Tube with the ore ground to different sizes.

Results

Test No	Grinding k_{80} = µm	Products		Weight %	Fe -% Assay	Fe -% Distrib.
2 A	100	Magnetic		62,4	55,3	86,9
		Non-magnetic		37,6	13,9	13,1
		Feed	Calc	100,0	39,7	100,0
			Anal		39,8	
2 B	70	Magnetic		54,4	61,9	85,9
		Non-magnetic		45,6	12,1	14,1
		Feed	Calc	100,0	39,2	100,0
			Anal		39,8	
2 C	45	Magnetic [1]		49,2	68,0	85,1
		Non-magnetic		50,8	11,5	14,9
		Feed	Calc	100,0	39,3	100,0
			Anal		39,8	

[1] 3,67 % SiO_2, 0,87 % MnO, 0,015 % P_2O_5, 0,02 % TiO_2, 0,017 % S

Screen analyses. Feed to magnetic separation

Apeture µm	Cum % fines Test 2A	Test 2B	Test 2C
210	99,9		
150	96,9	99,8	
105	81,6	98,2	99,9
75	59,0	83,9	99,1
53	40,9	60,2	90,6
38	26,0	39,0	65,6
k_{80} = µm	100	70	45
Grinding time mins.	10	20	40

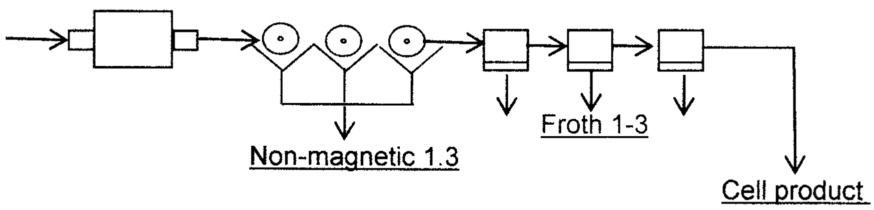
CONCENTRATION TESTS WITH MAGNETITE FROM "KALLAK-DEPOSIT"

App. 4

Test 3 Magnetic separation on Blue Ribbon in three steps, follow by quarts flotation of magnetic product.

Testmaterial 2 x 1 kg of feed ground in a stainless mill with dito rods to k_{80} = 45 µm.

Flowsheet



Results

Reagent g/t [1)]	pH	Mins Mix	Mins Flot	Products	Weight %	Fe -% Assay	Fe -% Distrib.
				Magnetic 3 = to flot.	52,5	65,1	85,7
				Non-magnetic 1-3	47,5	12,0	14,3
83	8,3	1	3	Froth 1	2,8	46,2	3,2
				Middling 1	49,7	66,2	82,5
28		1	3	Froth 2	3,6	49,2	4,5
				Froth 1-2	6,4	47,9	7,7
				Middling 2	46,1	67,5	78,0
28		1	3	Froth 3	5,8	56,0	8,1
				Froth 1-3	12,2	51,7	15,8
	8,2			Cell product [2)]	40,3	69,2	69,9
139	–	3	9	Feed Calc Anal	100,0	39,9 39,8	100,0

[1)] Lilaflot D 817 M, calc. on feed to flotation.

[2)] 2,48 % SiO_2, 0,89 % MnO, 0,014 % P_2O_5, 0,03 % TiO_2, 0,011 % S

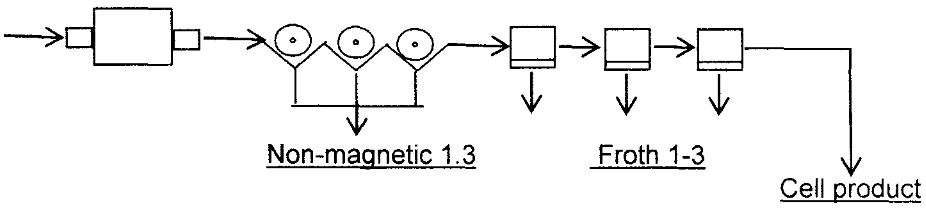
CONCENTRATION TESTS WITH MAGNETITE FROM "KALLAK-DEPOSIT"

App. 5

Test 3 Magnetic separation on Blue Ribbon in three steps, follow by quarts flotation of magnetic product.

Testmaterial 2 x 1 kg of feed ground in a stainless mill with dito rods to k_{80} = 45 µm.

Flowsheet



Results

Reagent g/t [1]	pH	Mins Mix	Mins Flot	Products	Weight %	Fe -% Assay	Fe -% Distrib.
				Magnetic 3 = to flot.	52,5	65,1	85,7
				Non-magnetic 1-3	47,5	12,0	14,3
83	8,3	1	3	Froth 1	2,8	46,2	3,2
				Middling 1	49,7	66,2	82,5
28		1	3	Froth 2	3,6	49,2	4,5
				Froth 1-2	6,4	47,9	7,7
				Middling 2	46,1	67,5	78,0
28		1	3	Froth 3	5,8	56,0	8,1
				Froth 1-3	12,2	51,7	15,8
	8,2			Cell product [2] [3] [4]	40,3	69,2	69,9
139	–	3	9	Feed Calc Anal	100,0	39,9 39,8	100,0

[1] Lilaflot D 817 M, calc. on feed to flotation.

[2] 2,48 % SiO_2, 0,89 % MnO, 0,014 % P_2O_5, 0,03 % TiO_2, 0,011 % S

[3] Screen analyses

Fraction µm	Weight %	Fe -% Assay	Fe -% Distrib	SiO_2 -% Assay	SiO_2 -% Distrib
53	9,9	64,4	9,2	7,7	31,9
38	29,1	68,5	28,8	3,3	40,1
<38	61	70,3	62,0	1,1	28,0
Feed Calc. Anal.	100,0	69,2 69,2	100,0	2,5 2,4	100,0

[4] Magnetic separation, Davis Tube

Products	Weight %	Fe -% Assay [1]	Fe -% Distrib	SiO_2 -% Assay	SiO_2 -% Distrib
Magnetic	96,7	70,4	99,3	1,5	61,0
Non-magnetic calc.	2,4	20,4	0,7	39,0	39,0
Feed anal.	100,0	69,2	100,0	2,4	100,0

[1] Na_2O 0,007 %

K_2O 0,015 %