

PRELIMINARY TREATMENT OF THE COPPER SLAGS

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ABSTRACT

It is examine preliminary treatment of the copper slag's, product obtained in process of black lead copper cleaning. The slag's are separated in two products - one rich with lead, and the other with copper. Thesis products can treated directly in lead and accordingly copper smelting. By that the lead recovery in lead smelting goes up, the NaOH consummation goes down and furnace productivity increases too.

INTRODUCTION

Pyrometallurgy is the main metallurgical method for lead concentrates treatment. It is obtained black lead with As, Sb, Sn, In, Zn and Cu like impurities. The first stage of cleaning is to remove copper in copper slag's. In relationship with composition of the input lead concentrates and treatment parameters, the copper slag's contains: 45-47 % Pb; 10-20 % Cu; to 7 % - Sn, Se, Te, In and precious metals to 0,12 %. In copper slag's transmit 11 % from black lead. In directly metallurgical treatment it is obtained like middling "stain" and "shpaza" which go to metallurgical treatment. The booth products are rich of copper, but contain some amount of lead which goes out of lead smelting. The but of present investigation is to check possibilities for copper slag's separation before metallurgical treatment in two products - one rich to lead and the other rich to copper. Each of them can treated more effectively, than lick copper slag's.

CHARACTERIZATION OF THE SAMPL AND METHODS

It was investigated two samples from copper slag's. The contains of the main components and sizometrical analyze are given in table 1.

The carried out mineral and chemical analyzes showed that the samples are very similar. They are heterogeneous mixture from powder and granule material. The granule material is from metal grains containing metal lead or hard solution between copper and lead. The powder material is presented with complicated substances from Cu, As, Te and S. The phase analyses have shown that 80 % input lead is in metal form. The rest part is PbS and small part CuS. To 80 % from Cu is lick substances with As and Sb (Cu_3As , Cu_3Sb), ore in halkozin and bornite. The small part of copper is in metal form.

In relationship with conditions of the lead solidifying the surfaces of the sulfides are oxides in different stage. Fe is in from of the chemical substance with As ore FeSO_4 . Gold is lick substance with Pb and Cu. Ag is in hard solution with Pb. The amount of the rock minerals is very little.

The fraction analyze of the copper slag's was made by the havy liquids (CaCl_2 , Fe_2Si_3) at density 2,5 g/cm³; 3,0 g/cm³; 3,5 g/cm³. The obtained results are given in table 2 and table 3.

The milling properties of the copper slag's were investigated by relative production of the class -0,068 mm in t/m³ for rod grinding, ball grinding, semiautogenous grinding and fullatogenous grinding (fig. 1).

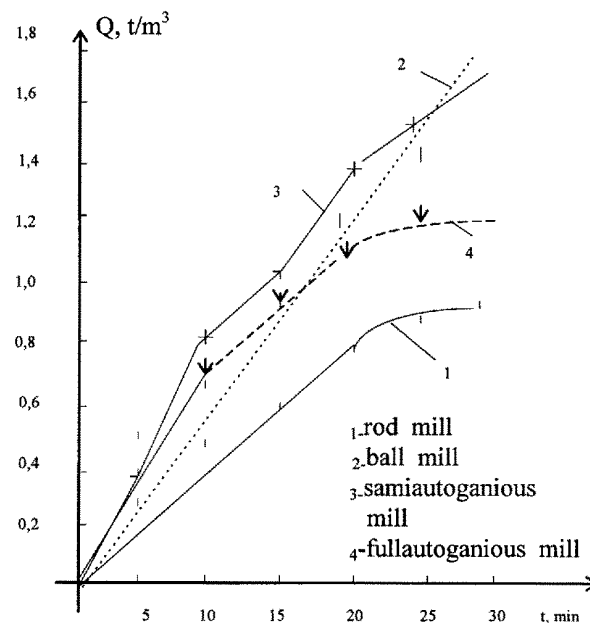


Fig.1. Influence of the milling time (t , min) on the relative productivity (Q , t/m³) in class -0,068 mm

The rod grinding was investigated by laboratory mill L = 40 cm and D = 20 cm, with rods ϕ 20 mm, φ = 36 %.

The fullautogenous grinding was investigated in mill L = 25 cm and D = 40 cm.

The ball grinding was investigated by laboratory mill L = 30 cm, D = 35 cm, with balls ϕ 16 mm, φ = 42 %.

The input in all tastes was 500 g copper slag's; W: S 1 : 1.

The semiautogenous grinding was investigated by laboratory mill L = 25 cm, D = 40 cm, 10 % balls ϕ 16 mm.

The obtained results are given in table 4.

Table 1. Characterization of the samples from copper slag's

№ of the sample	Size-mm; γ , %						Chemical contains, %			
	+3,0;	+1,0;	+0,25;	+0,12;	+0,063;	0,063;	Pb	Cu	Sb	As
I	38,68	57,85	68,29	83,79	94,99	100,00	62,74	16,89	3,56	2,43
II	41,20	59,83	69,04	85,77	95,45	100,00	53,75	19,38	4,71	3,20

Table 2. Fraction analyze with recovery of the metals in fractions

Density of the have liquid g/cm ³	Size, +3,0mm Recovery, Cu,% Pb,%		Size, -3,0 +1,0mm Recovery, Cu,% Pb,%		Size, -1,0+0,25 mm Recovery, Cu,% Pb,%		Size, -0,25 +0,12mm Recovery, Cu,% Pb,%		Size, -0,12 +0,063mm Recovery, Cu,% Pb,%		Size, -0,063mm Recovery, Cu,% Pb,%	
	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%
2,5; floated	3,75	0,30	7,19	0,76	2,52	3,25	8,88	0,80	9,38	9,38	52,49	58,22
3,0; floated	8,55	3,88	29,01	13,87	24,69	17,12	52,52	30,44	43,92	34,94	25,66	20,81
3,5; floated	24,10	17,44	31,17	30,76	46,91	47,88	32,12	35,29	42,21	42,19	1,83	6,84
3,5; settled	63,30	78,38	32,68	54,61	25,88	32,35	7,26	33,47	13,49	13,44	14,02	14,13
Input sample	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0	100,0

Table 3. Fraction analyze with metal contains in fractions

Density of the have liquid, g/cm ³	Size, +3,0 mm Contain, Cu,% Pb,%		Size, -3,0 + 1,0mm Contain, Cu,% Pb,%		Size, -1,0 +0,25mm Contain, Cu,% Pb,%		Size, -0,25 +0,12mm Contain, Cu,% Pb,%		Size, -0,12 +0,063mm Contain, Cu,% Pb,%		Size, -0,063 mm Contain, Cu,% Pb,%	
	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%	Cu,%	Pb,%
2,5; floated	24,17	6,20	12,12	7,80	8,63	30,10	5,60	8,88	24,40	3,10	19,21	32,75
3,0; floated	31,33	45,00	27,71	35,65	11,09	78,81	46,28	52,52	16,14	35,80	27,30	34,00
3,5; floated	26,30	60,20	10,11	60,17	7,12	77,20	42,10	32,12	12,11	33,10	27,35	36,65
3,5; settled	20,20	73,10	8,10	82,60	6,15	81,70	7,26	79,79	16,15	61,60	27,30	41,79

Table 4. Pb and Cu contains in class -0,068 mm at different tips millings.

Milling time, min	Rod mill Contain, %		Ball mill Contain, %		Semiautogenous milling (10 % balls) Contain, %		Fullautogenous milling Contain, %	
	Pb	Cu	Pb	Cu	Pb	Cu	Pb	Cu
10	20,2	24,2	19,8	26,2	18,3	28,6	18,1	29,2
15	21,6	25,6	20,6	25,5	20,6	26,2	21,4	28,1
20	23,5	19,4	24,7	24,2	24,3	25,9	22,6	26,2
25	26,7	21,5	30,9	19,5	30,6	25,6	28,3	24,3
30	30,1	16,2	36,8	20,5	32,4	24,2	30,1	20,6

RESULTS AND DISCUSSION

Analyze of the obtained results from chemical and gravity investigations show:

1. The main part of the copper slag's is in grains with size up to 0,25 mm.
2. The rich lead containing grains are with average size up to 0,25 mm and relative density up to 7,0 g/cm³.
3. The rich copper containing grains are with down to 0,25 mm and density down to 7,0 g/cm³.

4. Increasing of the grinding time goes to increasing the yield the grains down to 0,068 mm with increasing the contains of the lead and copper in.
5. The relative production of the mills is highest by ball grinding, but selectivity of the autogenous grinding is better.

On base of results of the carried out investigations we created flowshit for copper slag's treatment (fig.2). The obtained results are given an fig. 2 too.

The lead rich product was treated by smelting with 15 % lead concentrate, 6 % NaOH and 4 % coke in laboratory furnace. The obtained metal lead contains 97,60 % Pb; 1,03 % Cu; with 96,62 % recovery of the lead and 9,62 % recovery of the copper.

The copper rich product was treated with 22 % lead concentrated, 10 % NaOH - and 94,97 % Pb and 2,98 % Cu with 87,3 % recovery of the lead and 2,98 % recovery of the copper.

The suggested flowshit for copper of lead to rest in lead smelting and only little part goes to copper smelting. In results the recovery of the lead goes up and consummation of NaOH goes down.

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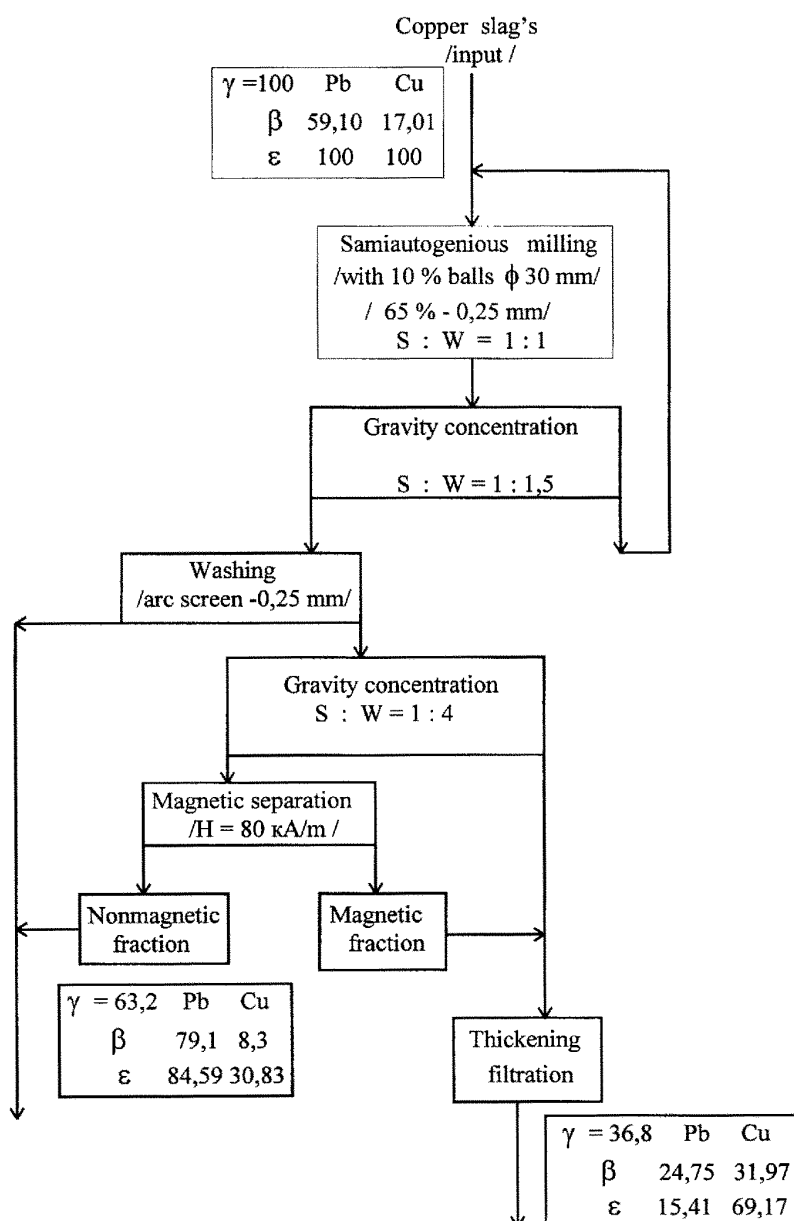


Fig.2. Flow shit in closed circuit for copper slag's treatment