

THE INDUSTRIAL TEST OF CONCENTRATION OF CONCENTRATION OF SLOWLY COOLED CONVERTER SLAG

ПРОМЫШЛЕННЫЕ ИСПЫТАНИЯ ПО ОБОГАЩЕНИЮ МЕДЛЕННО ОХЛАЖДЕННОГО КОНВЕРТОРНОГО ШЛАКА

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Abstract: Nowadays are very actual problems of working out waste of non-ferrous metallurgy such as converter slags of the copper enterprise. One of the new direction of additional extraction of copper from slags of converter section is combine method including mechanochemical activation and concentration by flotation of nanostructured initial material. The first stage - is receiving thin crumbled material with high degree of dispersion. This permit furnish an explanation of noticeable changing of properties of high dispersion materials: appearance of activity centers on the surface of minerals because there are alterations and become activity of electronics structures of surfaces layers as consequence of modification of surface. Moreover, take places processes of opening of capsules, including captured particles of some components (metals, minerals from slag, such as copper sulphides etc.). As far as, converting is going with high speeds it's possible mechanical capturing of initial particles which didn't participate in interaction during of process converting, minerals may be screened by slag melt. Under the condition of the slowly cooling predominated kinetic mechanism of heterogenic interaction in the silicacontaining system. On the basis of investigations was worked out the technological regulations and fulfilled the industrial probation.

KEYWORDS: CONCENTRATE, SLOWLY COOLED CONVERTER SLAG, FLOTATION, COPPER, EXTRACTION.

1. Introduction

One of the new direction of the additional extraction of copper from slags of converter section is the combine method, which includes mechanichemical activation and concentration by flotation of nanostructured initial material.

The converter slag was slowly cooled after converter in special cups during 3-4 twenty-four hours and then it was transported on storage-place. The large blocks 400-500mm were treated in crusher after that it were growing small in mill.

The first stage is receiving the thin crumbled powdery material with high degree of dispersion. This permit an explanation a noticeable changing of properties high dispersion materials: appearance of activity centers on the surface of minerals because there are alterations and activity of electronics structures on the surface layers as consequence of modification of surface. Moreover, take place processes of opening of capsules including of particles of components such as metals, minerals from slag: copper sulphides etc. As far as treatment in converter is going with high speed it's possible the mechanical capturing in the silica melt the initial particles which did not took part in interaction during of process converting, sulfides may be screened by slag melt. Under the condition of slowly cooling the kinetic (dynamic) mechanism of heterogenic interaction in system is predominated [1-5].

Slag includes the complex components, anions, ions etc. because there are different silica-oxygen complexes in slag. It's analogy of cooling melt of magma. The phase composition of slag is very complex because there are mobile equilibrium take place between different silica-oxygen complexes which defined by quantity solved oxygen in melt. It's observed polymerization of the metasilica complex: $n[\text{SiO}_3]_{2n} + n\text{O} = n[\text{Si}_2\text{O}_7]\text{SiO}_2$ which adding oxygen is forming groups of $[\text{SiO}_3]_n$; $n[\text{SiO}_3]_n$; $n\text{SiO}_2 + n\text{O} = [\text{SiO}_3]_n$; it's possible formation of complexes $[\text{Si}_2\text{O}_5]_n$ in accordance with scheme: $2n\text{SiO}_2 + n\text{O} = [\text{Si}_2\text{O}_5]_n$.

Moreover, it's possible capsulation of sulphur-containing minerals such as CuS, Cu₂S, CuFeS₂ etc. The mechanochemical activation is promoting increase of interaction in system.

The phase composition of slag is very complex and the mechanochemical activation create additional conditions for direct opening minerals of copper.

2. Fulfilmenttests

Tests were carry out on Balkhash plant in accordance with program of testing. At first during of five twenty-four hours was taken about 1500 ton of the slowly cooled converter slag. It was used new regime cards, control of the regime parameters fulfilment by the Laboratory of technological investigations of Balkhash Enrichment factory. Results of tests (volumes products and per-two hours analysis) duration of tests were taken from reports of service of the Enrichment factory in accordance of timely inventory registration. The timely registration fulfilment at every day. There are results of tests presents in tables where show characteristics of products, simples, contents metals, productivity etc. [6-8].

The growing small initial material passed two stages with classification in hydrocyclone into closed cycle after the first stage of growing small on class - 0,074mm up to 55%. After the second stage the communitied very small crusing slag of class - 0,074mm up to 92-94% was given into between stage of flotation. Concentrate after that was given as a ready product and directly into apparatus of thickening. The tailings, which received between stages of flotation directed into the third stage of additional communitie to lump size of class - 0,074mm up to 90-95%. It was defined in average in initial material 5-6% Cu, in tailings 0,58-0,64%, degree of extraction by additional concentration preliminary 90-95% Cu.

Further in process of investigations was reached higher results (Table). At 04.11, 06.11, 07.11 were reached high degree of extraction cooper from concentrate: 94,7; 95,1; 95,9 accordingly (Table). Quality of concentrate is 25,4%

In accordance with the general probation which was at 5 November 2014yr. till 16-00 hour, when treated the slowly cooled slag received meaning of extraction cooper 95,0% and content cooper in initial slag 5,69%, in tailings (waste) 0,58% Cu and quality of concentrate 33,9% Cu.

Data	Time	Initial Cu in waste %	Tailings, %	Extraction Cu., %	Concentration, %	0,074 MM	Was treated,т
01.11. 2014	02.00	1,74	0,43	77,6	14,6 (6-8)		40
	04.00	2,22	0,42	82,4	14,5 (6-8)		40
	06.00	4,27	0,45	91,5	14,6 (6-8)		45
	08.00	4,31	0,75	85,7	14,7 (6-8)		40
	Shift	1,74/1,78	0,40/0,53		23,40/24,64	58	165
	10.00	2,68	0,62	78,7	25,9		55
	12.00	2,48	0,84	68,1	29,1		55
	14.00	2,71	0,69	77,6	17,6		55
	16.00	4,7	0,61	89,6	21,59		55
	Shift	3,24/3,36	0,69/0,73		22,48/23,49	67	220
	18.00	5,49	0,63	92,9	24		56
	20.00	3,76	0,63	95,6	22,9		56
	22.00	4,15	0,62	89,4	23,4		56
	24.00	6,29	0,59	93,0	22,8		55
Shift	4,93/5,12	0,61/0,65		/22,71	65	223	
02.11. 2014	02.00	4,72	0,57	90,9	17,2		59
	04.00	4,86	0,59	91,4	15,4		59
	06.00	4,09	0,57	94,8	18,4		59
	08.00	6,62	0,57	94,1	19,6		59
	Shift	5,04/5,27	0,56/0,58		17,19/17,50	47	237
	10.00	4,97	0,53	92,8	19,5		52
	12.00	5,38	0,54	92,6	19,1		52
	14.00	4,8	0,58	91,1	16,5		53
	16.00	4,82	0,58	92,7	14,4		50
	Shift	4,84/4,96	0,58/0,61		17,4/17,41	52	207
	18.00	5,23	0,54	92,8	16,1		52
	20.00	5,8	0,59	93,3	15,95		52

Table 1. The journal of work out. An examples of control technological parameters

Results of the operating control given in table 1 (For example). During of industrial test of the slowly cooled converter slag accordance with average operating calculation shows, that initial maintenance Cu is 4,72%, in tailings – 0,57%, degree of extraction 92,4%Cu and quality of concentrate 27,4%Cu.

Table 2. Dynamic of changing degree of extraction copper in to concentrate in during tests

Date	Degree of extraction of Cu, %	Remark
01.11.14	93,3	An average volume took
02.11.14	94,1	in accordance of 5-6 measurements
03.11.14	93,9	on day
04.11.14	94,7	
05.11.14	95,0	
06.11.14	95,1	
07.11.14	95,9	
08.11.14	92,8	
09.11.14	93,7	

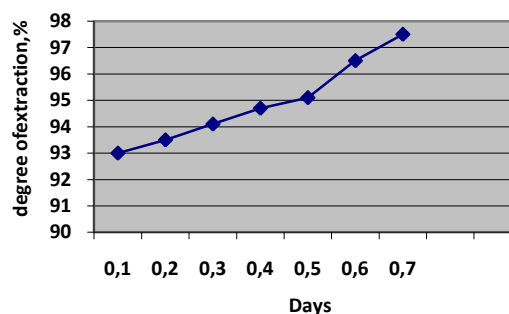


Figure 1. Dynamic of changing of degree of extraction copper into concentrate

So, process of an extraction and concentration copper from waste of converter division of the copper enterprise include the basic flotation, one stage of sour operation and the control flotation. Concentrate of the sour flotation given into thickener as a ready product, tailings of scour and cameral product of the control flotation recycling with tailings between stages of

flotation into the third comminute, tailings of the control flotation go to waste.

3. Conclusions

1. It was worked out the industrial tests of concentration of the slowly cooled converter slag and fulfilment estimation results of additional extraction cooper from the converter slag.

2. In accordance with the general probation treated the slowly cooled slag and received meaning of extraction cooper 95,0%, content cooper in initial slag 5,69%, in tailings (waste) 0,58%Cu and quality of concentrate 33,9%Cu.

4. References

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