ТЕХНИЧЕСКИЕ НАУКИ

STUDYING TECHNOLOGIES OF PRODUCING METAL LEAD FROM CONVERTER DUST OF COPPER MELT FACTORY JSC AMMC

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ANNOTATION

The article presents the results of the processing of converter dusts to produce metallic lead and a productive solution containing copper and zinc, which are sent for further processing.

Keywords: secondary raw materials, dissolution, industrial waste, dust processing, utilization, hydrometallurgy.

Introduction. Scientific and technological progress in the modern world is accompanied by a sharp increase in the consumption of natural resources and a simultaneous increase in the amount of industrial waste, the problem of rational use of which is closely connected with the efficiency of industrial production, environmental protection and new developments in the field of waste management [1, 2].

At present, in the territories of «Almalyksky MMC» JSC, fine converter dusts of a smelter are accumulating, which are technogenic deposits of a unique composition of polymetallic raw materials, which are currently practically not used. Therefore, research aimed at developing a technology for processing thin converter dusts, with the extraction of heavy non-ferrous metals from them, is very relevant.

Objects and research methods. For research, thin converter dusts were used with an average content (%): 31,56 Pb; 2,2 Cu; 14,7 Zn; 0,46 Fe; 0,65 SiO_2; 11,47 S_{total}; 8,52 S_{SO4}; 0,33 MgO; 2,84 CaO; 0,19 Cd and industrial grade noble metals.

Fine converter dust is formed during the purification of process gas in electrostatic precipitators, which is formed during the conversion of copper and sent to the production of sulfuric acid. Dust of electrostatic precipitators is a white or light gray finely dispersed mobile powder with a particle size of less than 14-30 microns. The bulk density of dry dust is 0.5 g/cm^3.

The main components of dust are easily open forms: CuO (gray tenorite), Cu_2O (red cuprite), $CuSO_4$ (white anhydrous or blue chalcocyanite with a yellow tint), etc. ($ZnSO_4$, $FeSO_4$, $PbSO_4$) [3]. Mineralogical (using a MIN-7 optical microscope in reflected light) and X-ray diffraction (in an URS-50IM device with Co Ra radiation) analyzes show the peculiarity of dusts, which consists in the presence of significant amounts of sulfate forms of non-ferrous metals in them: 70- 72% sulfate, 18-20% sulfide (mainly in the form of covellina) and 10-11% oxide-silicate; iron 70-72% in the form of magnetite and 28-30% - sulfate of 2-valent iron; lead and zinc are 80% in sulfate form.

Results and its discussion. To separate copper, zinc and iron into the solution, sulfuric acid leaching of converter dust was carried out with the addition of an oxidizing agent (manganese concentrate), with a sulfuric acid content of 80 ÷ 120g/l in the pulp at a temperature of 60-90 °C, for 2 hours, S:L = 1:3 ÷ 8 according to the developed technological scheme (Fig. 1). The results of sulfuric acid leaching are shown in table 1.

As a result of leaching at a given ratio of S:L = 1: 3 ÷ 8, sulfuric acid is neutralized from the initial concentration of 80 ÷ 120 g/l to a pH of 0.8-1 (30-35 g/l).

After filtration, the precipitate was washed with water to pH = 5.5 ÷ 6.0 at a water temperature of 80 °C. The resulting solution with a copper content of 5 g/l and zinc of 22.5 g/l is a productive solution for the extraction of zinc and copper.

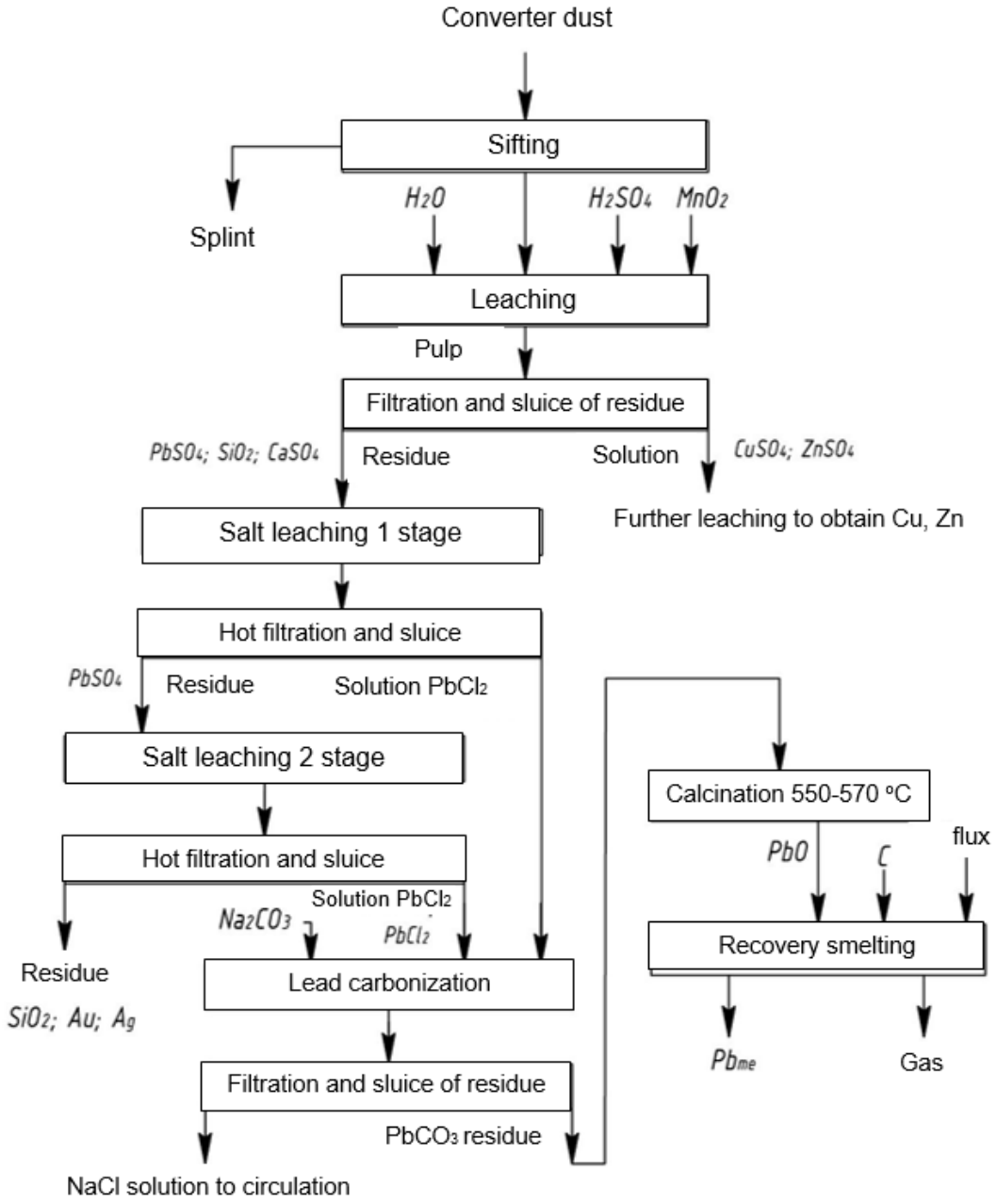

Fig. 1. The developed technological scheme for processing thin converter dust of smelters.

When dust is leached with sulfuric acid, the following reactions occur:

conversion of lead oxides to sulphate precipitate:

$$PbO + H_2SO_4 \rightarrow PbSO_4 + H_2O$$

transfer of zinc and copper into solution:

$$ZnO + H_2SO_4 \rightarrow ZnSO_4 + H_2O$$

$$CuO + H_2SO_4 \rightarrow CuSO_4 + H_2O$$

Table 1.

The effect of temperature and S:L on the degree of dissolution of Cu and Zn in solution

t, °C	The degree of dissolution of Cu and Zn,%											
	S:L=1:3		S:L=1:4		S:L =1:5		S:L =1:6		S:L =1:7		S:L =1:8	
	Cu	Zn	Cu	Zn	Cu	Zn	Cu	Zn	Cu	Zn	Cu	Zn
60	18	12	26	17	34	23	53	39	72	54	70	74
70	32	20	45	35	55	48	75	59	84	70	80	76
80	44	30	56	46	76	60	85	74	95	86	92	88
90	45	40	58	52	77	63	84	75	94	84	90	88

From the obtained data it is seen that in more diluted pulps with increasing temperature, the degree of dissolution of copper and zinc increases.

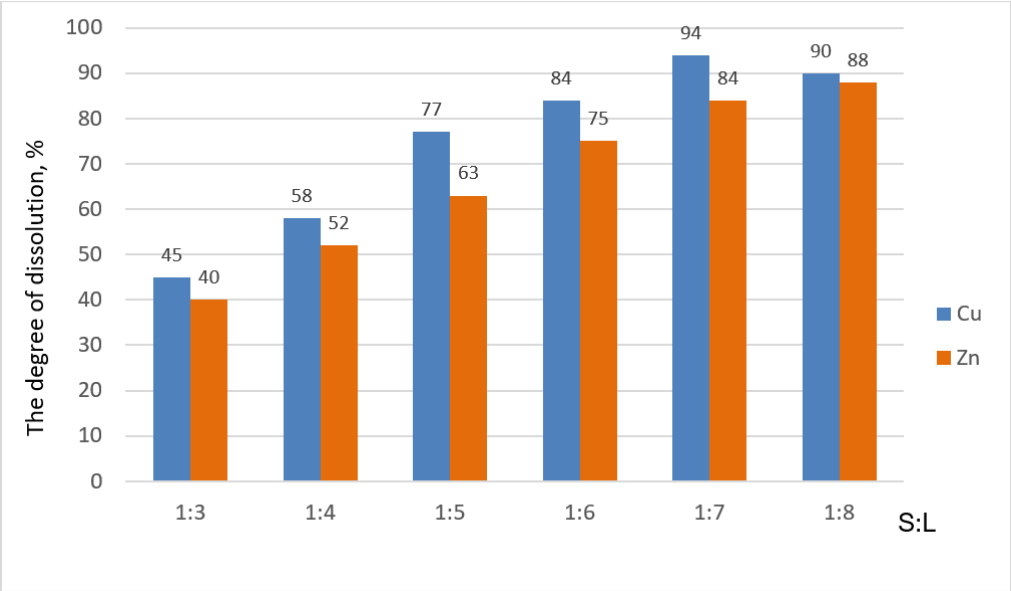

Fig. 2. The dependence of the degree of dissolution of Cu and Zn from S:L at temperature 90 °C.

The residue obtained after sluice is sent to the first stage of salt leaching. The concentration of sodium chloride is 250 g/l, the temperature of the process is 90-95 °C, the leaching time is 2 hours, the ratio S:L = 1:7. The resulting slurry was subjected to hot filtration, since lead chloride ($PbCl_2$) precipitated at low temperature.

After filtration, the obtained cake is sent to the second stage of salt leaching at a sodium chloride concentration of 150 g/l, the process temperature is 90-95 °C and the leaching time is 2 hours.

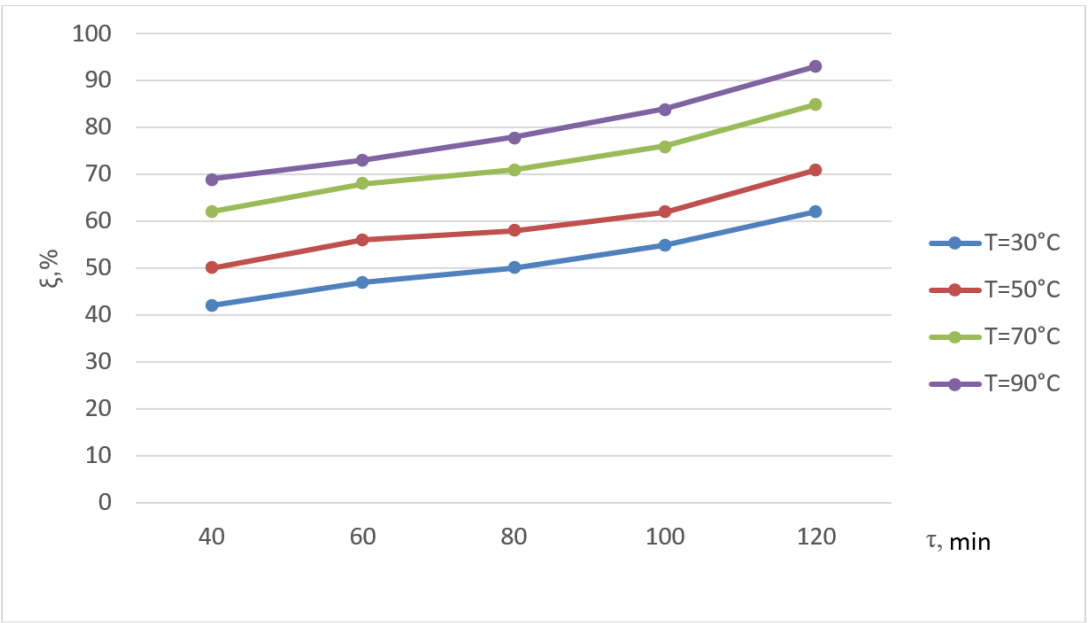

Fig. 3. The dependence of the degree of dissolution of lead after stage II of salt leaching into solution on the duration of the process and temperature

The solutions of the first and second stages of salt leaching were combined and calcined technical soda was added. Carbonization of lead is adjusted to pH 8.5-9. The obtained $PbCO_3$ residue was calcined at a temperature of 550-570 °C and glute (PbO) was obtained. Gluet with the addition of flux and graphite was subjected to reduction smelting and metallic lead with a lead content of 99.87% was obtained.

Thus, the studies showed that it is possible in principle to process converter dust to produce premium

grade metallic lead. Processing of converter dust according to the developed technology allows to increase the yield of metallic lead with high extraction and the best technical, economic and technological indicators.

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IMPROVING THE EFFICIENCY OF PARAMETERS OF THE IMPELLER BLADE OF PUMPING EQUIPMENT

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ИССЛЕДОВАНИЕ ОПТИМАЛЬНЫХ ПАРАМЕТРОВ ЛОПАСТИ РАБОЧЕГО КОЛЕСА НАСОСНОГО ОБОРУДОВАНИЯ

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ABSTRACT

Annotation. The article analyzes the main reasons for failures of ground pumps, which are poor-quality seals, imperfect design of the impeller mounting on the pump shaft and bearing units, as well as the angular location of the impeller blade of pumping equipment. The influence of the impeller parameters is studied. The methods of