JOURNAL OF MULTIDISCIPLINARY SCIENCES AND INNOVATIONS

VOLUME 04, ISSUE 11
MOPNTHLY JOURNALS

ISSN NUMBER: 2751-4390
IMPACT FACTOR: 9,08

IMPROVEMENT OF ZINC PLANT SECONDARY WELTS OXIDES RECYCLING METHODS

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Abstract: In the Republic of Uzbekistan, lead metal is mainly produced at the lead plant owned by Almalyk MMC JSC. Production is carried out in the traditional way through the processes of enrichment roasting, selective smelting of lead and electrolysis. The lead cake formed during the selective smelting process is roasted in a welschizing furnace with the participation of coke. The secondary welschizing oxide (SVO) formed as a result of the purification of raw welschizing oxide (RVO) from halogens and reducing agents by roasting was first washed and roasted at high temperatures in the presence of limestone and coke powder. As a result of the experiments, the chemical composition of the products obtained was studied.

Key words: zinc metal, zinc cake, crude welts oxide, chlorine, fluorine, reducing agent, welding process, secondary welts oxide, washing process, coke fine, limestone.

Introduction. Today, at the "Almalyk MMC " JSC zinc plant, sulphide enrichments are burned in fluidized bed furnaces. The soot is selectively dissolved in sulfuric acid solutions to form a zinc cake and a neutral solution of zinc sulfate. Coke fines and zinc cake are mixed in a ratio of 1:2 and processed in rolling furnaces. During the rolling process, RVO and copper clinker are formed. RVO is purified from halogens and reducing agents by roasting in multi-bottom furnaces. In the process of collection, SVOs are collected in narrow filters (1.5-3.0 t/day). Due to the high amount of halogen in SVOs, it is not recommended to add zinc cakes to welding. They are processed in fluidized bed furnaces with the presence of zinc sulfide enrichment. Halogens accumulated in SVOs pass through the process waste gases to the sulfuric acid production workshop and have a negative impact on the production process and equipment.

Literature review and methodology. In order to prevent the accumulation of chlorine and fluorine in the solutions of the process of separating lead, cadmium, and indium in the RVO using the hydrometallurgical method, they must be purified from halogens [1].

In the Chelyabinsk zinc plant, previously, RVOs were cleaned from halogens by washing, and since 2010, cleaning has been carried out in tubular furnaces [2].

Halogens can also be removed from RVOs by the copper-chlorine treatment method, but this method consumes a large amount of copper cake and does not allow maximum removal of fluorine. You can also wash it with soda water. About 20-30 percent of chlorine can be removed by this method, but the ecology of the environment may be damaged as a result of this method [3].

Today, at the Chelyabinsk Spirit Plant in the Russian Federation, RVOs are being cleaned of halogens by heating them in tubular furnaces at high temperatures (1,100-1,150 °C) with high efficiency [4]. Halogens combine with non-ferrous metals in RVO in the form of the following

compounds: $PbCl_2$, KCl, $ZnCl_2$, $CaCl_2$, $FeCl_2$, NaF, PbF_2 , KF, ZnF_2 , CaF_2 , FeF_2 . As a result of heating at high temperatures, up to 70-90% of halogens in RVO are removed, sulfur, organic residues, iron from divalent to trivalent, silver and antimony to difficult-to-dissolve pentavalent, and metal forms of lead and cadmium are oxidized.

For the experimental test, a mortar prepared with the presence of limestone powder, SVO, zinc cake and coke powder was used. For the initial tests, SVO was applied without washing, and for subsequent tests, it was partially washed in water. A crucible necessary for high-temperature experiments and a SNOL 12-13 muffle furnace designed for laboratory work were used.

Research results and discussion. The chemical composition of zinc cake, RVO, SVO samples is presented in Table 1.

Table 1

Product name	Zn	Pb	Cd	Fe	Cu	Cl	F	As	Sb	returner
	%									
Zinc cake	21.8	7.2	0.2	15.1	1.8	0.03	0.002	0.1	0.01	0.1
RVO	61.2	15.6	1.0	1.1	0.35	0.35	0.08	0.07	0.012	1.3
SVO	39.7	12.6	1.3	0.9	0.7	3.1	0.6	0.33	0.06	2.9

Initial tests were carried out by preparing different proportions of SVO, coke fines, zinc cake and limestone powder at various temperatures and process durations. Changing the amount of limestone powder (in the range of 10-40 percent) was taken as the main indicator for the preparation of shikhta. The results are presented in Figure 1.

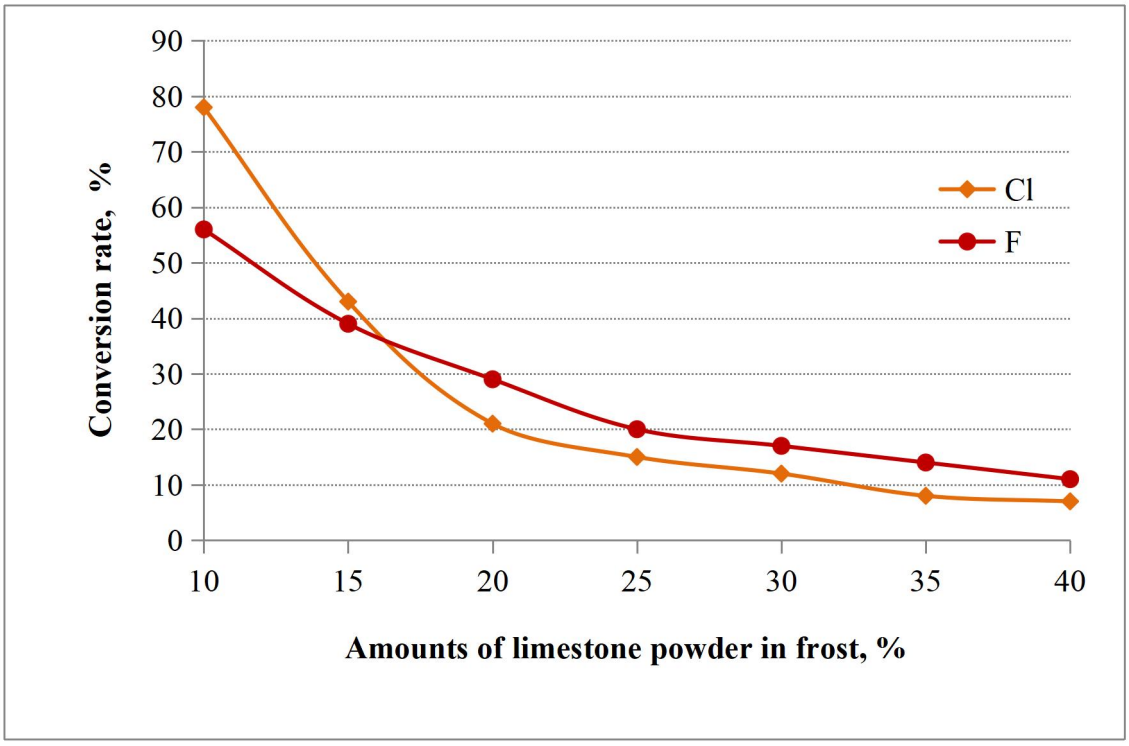

Figure 1. Changes in the amount of halogens in the samples according to the amount of limestone.

According to the results of the experiment, when the content of calcium oxide is higher than 20 percent, the emission of halogens is sharply reduced.

For subsequent tests, SVO samples were pre-washed with water, and a slurry was prepared with the presence of zinc cake, coke fines and limestone powder. The slag samples were heated at a temperature of 1200 °C for 120 minutes. At 10-minute intervals, the samples were mechanically stirred using a ceramic paddle. The chemical composition of heated samples was subjected to laboratory tests. Results and differences can be seen in Figures 2 and 3.

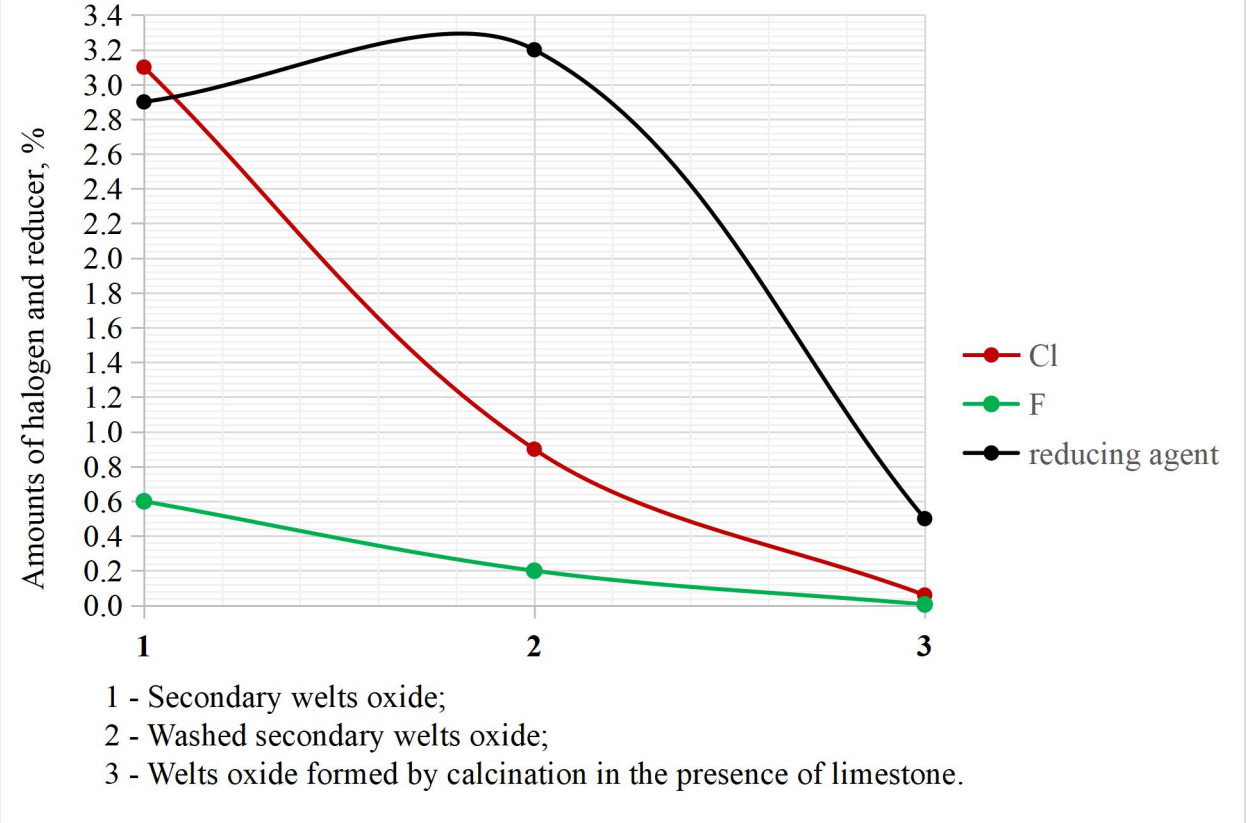

Figure 2. Distribution of halogens and reducers by samples.

According to the test results, pre-washing of the SVO can reduce the amount of chlorine and halogens by up to 3 times. At the same time, the amount of oxidants, iron and copper remains almost unchanged. We can see a slight increase in the amount of lead, cadmium and mercury.

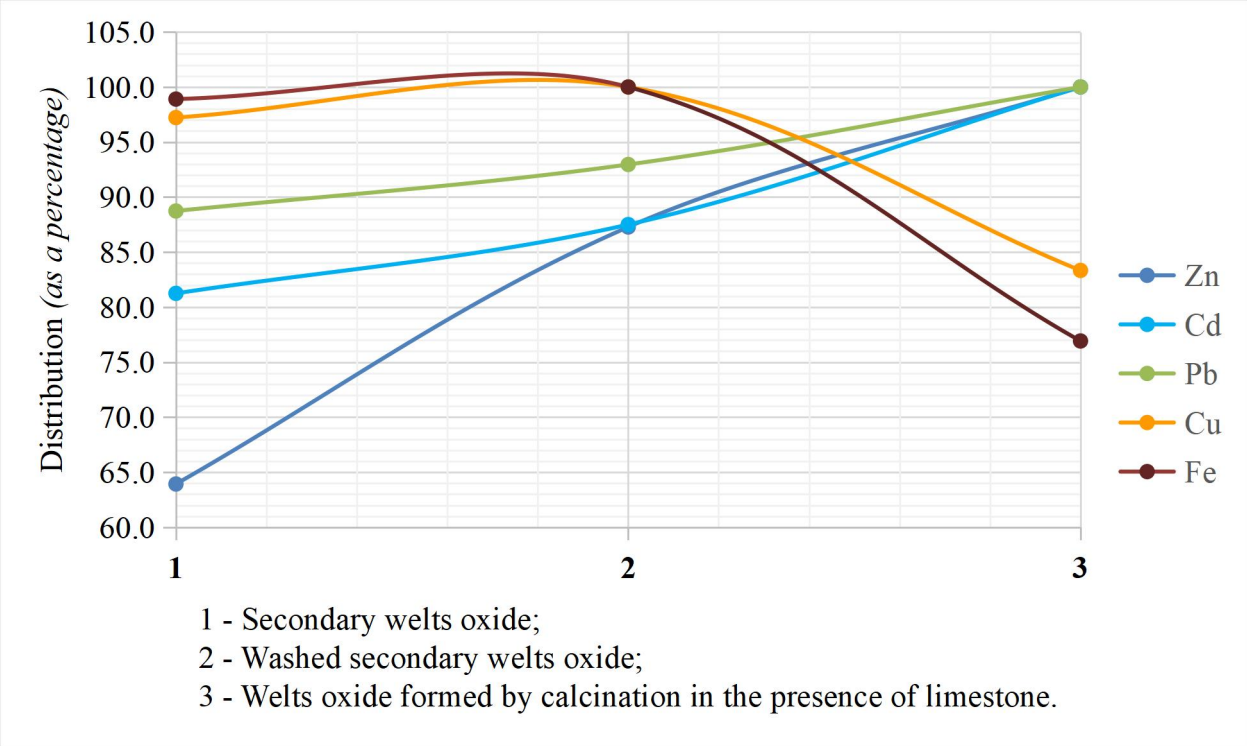

Figure 3. Distribution of non-ferrous metals by samples (For the purposes of the graph, the highest values are taken as 100 percent).

The next experimental test was carried out using a charge prepared with the participation of pre-washed SVO, coke powder, partially spirit cake and limestone powder. According to the results of chemical analysis of samples heated at a specified time and temperature, it can be observed that halogen, reducing agent, iron and copper in the charge (batch) decrease to a minimum, while the amounts of spirit, cadmium and lead increase to a maximum.

Conclusion. If the SVO is partially washed in advance and then heated at high temperatures, the halogens in its composition are removed to a high degree. Due to the low water consumption in the process, the negative impact on the environment is also minimal. As a result, it is possible to reduce the cost of producing spirit metal and improve the extraction of base metals.

In addition, by transferring chlorine and fluorine contained in zinc-containing waste to clinker, and zinc to launch, it will be possible to establish waste-free technology.

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