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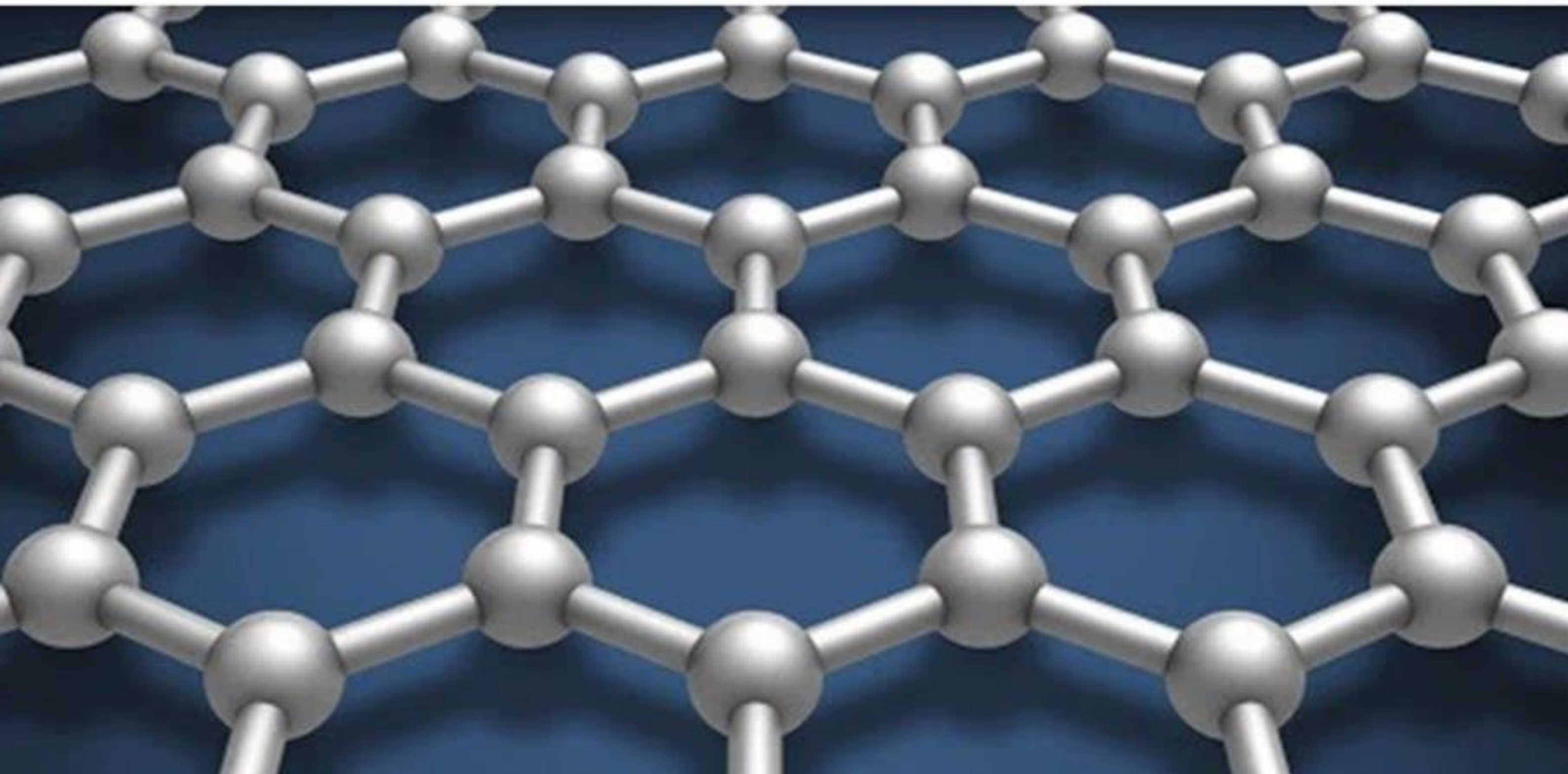
O'zbekiston

Kompozitsion Materiallar

Ilmiy-texnikaviy va amaliy jurnali



Узбекский научно-технический и производственный журнал

Композиционные материалы

микротўлқинли печ ичига 7 дақиқага қўйиб, энг юқори частотаси белгиланади. 7 дақиқадан сўнг тўлиқ суюқлантирилган алюминий қотишмаси керакли қолипга қуйиб олинади.

Ключевые слова: микроволновая печь, алюминий, тигель, базальт, карбид кремния.

Для плавления алюминия в микроволновой печи был изготовлен тигель с содержанием карбида кремния. В готовый тигель кладут 24 гр алюминия марки A000, помещают в базальтовую вату и помещают в микроволновую печь на 7 минут, устанавливая максимальную частоту. Через 7 минут полностью разжиженный алюминиевый сплав выливается в желаемую форму.

Key words: microwave, aluminum, crucible, basalt, silicon-carbide.

A crucible with a silicon-carbide composition was made to melt aluminum in a microwave oven. Put 24 GR A000 brand aluminum in the finished Crucible, placed in Basalt cotton and put in the microwave for 7 minutes, setting the highest frequency. After 7 minutes, the fully liquefied aluminum alloy is poured into the desired mold.

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ENRICHMENT AND PROCESSING OF MAN-MADE FORMATIONS AT JSC "ALMALYK MMC"

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Introduction. An increase in the yield of metal from processed ores, a decrease in the content of valuable metals in waste during production and their processing, as well as a decrease in rich and easily opened ore deposits, a decrease in the metal content in ores of ferrous and non-ferrous metallurgy indicate the need for special attention to increasing the complexity of the use of raw materials aimed at for the creation and implementation of scientific developments for the processing of man-made waste from the metallurgical industry.Technogenic waste from copper and zinc production is a serious problem in the regions of the metallurgical industry since they are stored in dumps and amounts to millions of tons, posing a danger to the environment [1].

At present, the available raw material reserves of quarries do not meet the needs of the processing plant; in connection with this, there comes a time in the metallurgical industry, when copper production slag containing a significant amount of copper 0.7-7% can be considered as an additional technogenic resource (Fig. 1 and Fig. 2) and iron above 35%.

In the process of smelting for the production of copper by the pyrometallurgical method, matte is present in the slag in the form of a suspension and tiny droplets that are entangled in the slag and do not have time to settle into the matte phase during the smelting of sulfide copper concentrates. For this reason, the possibilities of extracting copper and precious metals from technogenic formations of the mining and metallurgical industry are relevant. [2-5].

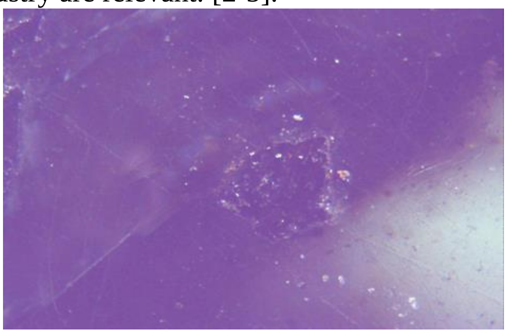

Fig. 1. Types of matte suspension in slag

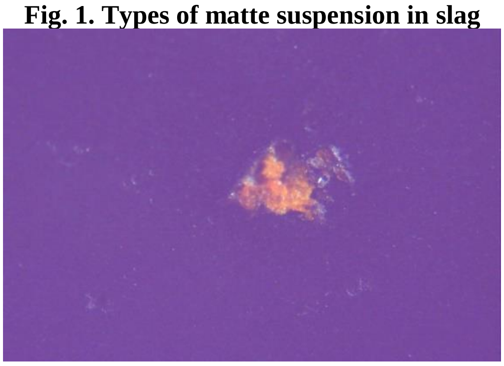

Fig.2. The presence of copper matte in the composition of the slag

In the processes of enrichment of technogenic raw materials of copper production, pyrometallurgical and hydrometallurgical methods are used. If the pyrometallurgical method of processing is unacceptable, the hydrometallurgical method is used, but the flotation method is an even more effective method. The fineness of grinding slag to a fineness of 90-95% of the class - 0.02 mm gives an increase in the extraction of copper into copper concentrate up to 10.3% [6].

Converter slags are processed by the pyrometallurgical method at “Almalyk MMC” JSC with a copper content of 2.7 - 3.3%, which is produced partly in a reverberatory furnace, and the other part at the processing plant of the plant. Since the reverberatory furnace cannot process the entire volume of converter slags from the copper plant of the plant, obtained by converting copper mattes from the reverberator and Vanyukov furnaces.

According to the technology, converter slag cannot be processed in the Vanyukov furnace. For this reason, the part of the converter slag not processed in the reverberatory furnace in the form of technogenic raw materials is shipped to the processing plant and, together with the ore, in which the copper content is 0.22-0.33%, is re-enriched to a concentrate (with a low sulfur content), and then goes for melting, with through extraction to blister copper no more than 50%. [7].

One of the main advantages of autogenous smelting in the Vanyukov furnace is the high productivity and production of SO_2-rich gases used in the production of sulfuric acid. When smelting in a reverberatory furnace, gases low in SO_2 content mixed with flue gases are not suitable for the production of sulfuric acid and are accordingly disposed of into the atmosphere [8].

The solubility of copper in the slag of copper smelting production should be minimal, however, slags with a high concentration of iron oxides, especially in the form of magnetite, dissolve more non-ferrous metals in the form of sulfide suspension. A high concentration of magnetite in the slag leads to an increase in copper losses with waste slag. And being in an excess state, magnetite is able to precipitate, falling into a solid precipitate, settling on the bottom of the furnace, forming a magnetite build-up during reflective melting and circulates as an undissolved suspension during melting in the Vanyukov autogenous furnace, which is the reason for the formation of copper-rich slags in this furnace [9].

In this work, research work was carried out, the purpose of which is to enrich the matte phase during the smelting of sulfide copper concentrates in a Vanyukov single-zone autogenous furnace, with the involvement in the production of technogenic raw materials in the form of converter slag and zinc production clinker at the copper plant of “Almalyk MMC” JSC.

On the basis of the research work carried out, a two-stage technology for extracting copper, gold and silver from converter slag into matte was developed during the smelting of copper sulfide concentrate in the Vanyukov furnace, at the copper plant of “Almalyk MMC” JSC.The first stage consists of in the recovery of slag magnetite in the converter in the process of converting copper mattes of the first period with a subsequent decrease from 20.0-28.0% to 6.0-10.0% and a decrease in copper by 30-50%. Slag containing magnetite up to a residual content of 8-10% is poured into warehouses for cooling. After that, the cooled converter slag is charged with concentrate and loaded into the Vanyukov furnace. The second stage of processing the reduced converter slag in the Vanyukov furnace proceeds to the state of the copper content in it from 2.2 - 3.5% to dump slag up to 0.6-0.7%.

Selection and justification of the objects of study. The main objects of research were industrial converter slags of “Almalyk MMC” JSC, the chemical composition of which is given in Table 1. Bothstale, accumulated and freshly formed converter slags were subjected to chemical analysis.

Table 1

Chemical composition of converter slags of “Almalyk MMC” JSC

№ slag	Content, wt. %								
	Cu	Zn	Pb	Fe	Fe_3O_4	SiO_2	CaO	Al_2O_3	S
1	2,94	1,95	1,3	47,0	20,7	22,5	1,95	3,20	1,0
2	3,57	1,75	1.1	46,9	21,1	19,1	1,57	3,11	0,90

To conduct laboratory studies and clarify the main reactions occurring in the process of reduction during conversion, the clinker composition was used, which is given in thetable. 2.

Table 2

The chemical composition of the clinker of the zinc plant of “Almalyk MMC” JSC

№ samples	Content, wt. %								
	Cu	Pb	Zu	SiO_2	S	C	Fe	Au	Ag
1	2,72	1,32	2,05	19,00	-	25,20	22,00	2,35 г/т	185 г/т

The practice of industrial tests for the recovery of converter slags consists of two stages. The first stage of converter slag recovery, composition, %: Cu-3.57; Zn-1.60; Fe-46.56; Fe_3O_4-21.2; SiO_2-19.1; CaO-1.57; Al_2O_3-3.26; S-0.70 clinker (5% of the weight of the slag) fraction +5 -10 mm is produced in the converter and continues in the stream of converter slag poured into the ladle, as well as in the ladle itself, bubbling the melt with a stream of converter slag falling onto the surface of the melt. The total consumption of clinker for the recovery of one ladle (18 tons) of converter slag is about 750 kg. The temperature of the slag is 1250-1280ºC. The resulting reduced slag has the composition, %: Cu-1.95; Zn-1.71; Fe-48.75; Fe_3O_4-9.25; SiO_2-20.3; CaO-1.6; Al_2O_3-3.45; S-0.9.

The reduced converter slag with such a low magnetite content is mixed with copper concentrate and loaded into the Vanyukov furnace, which is the second stage of slag processing.

Below are the results of practical experiments during the smelting of sulfide copper concentrate in the Vanyukov furnace without additives and with the addition of converter slag to the charge composition, where the following results were obtained, shown in tables 3 and 4.

Table 3

The content of copper in the waste slag of the Vanyukov furnace during the smelting of sulfide copper concentrate without the addition of converter slag to the charge composition

Waste slag	Cu	SiO_2	Fe	CaO
sample№1	0,64	28,84	50,11	2,80
sample№2	0,73	26,40	49,27	2,63
sample №3	0,65	28,52	51,63	2,91
sample №4	0,54	29,92	51,08	2,80
sample №5	0,62	29,16	50,11	2,86
sample№6	0,56	32,52	46,64	2,57
sample №7	0,63	29,74	48,44	3,64
sample№8	0,60	28,86	52,60	2,46
sample №9	0,55	31,00	48,58	2,69

The data in table 3 show the copper content in waste slag during operation of the Vanyukov furnace in normal mode without loading converter slag is 0.54 % - 0.73 %.

Industrial tests were carried out on the processing of reduced converter slags with a magnetite content of 6-10 % in the Vanyukov furnace, where in the table. 4 shows the results of studies on the content of copper in waste slag during the processing of recovered converter slags.

Table 3

The content of copper in waste slag from the Vanyukov furnace with the processing of reduced converter slag

Wasteslag	Cu	SiO_2	Fe	CaO
sample №1	0,65	34,20	51,83	2,58
sample №2	0,58	29,08	49,86	2,74
sample №3	0,59	27,56	50,27	2,35
sample №4	0,65	29,30	52,66	2,35
sample №5	0,69	30,24	52,35	2,69
sample №6	0,59	29,80	51,86	2,40
sample №7	0,61	29,40	50,58	2,24
sample №8	0,59	29,20	51,97	2,80
sample №9	0,68	29,12	52,05	2,40
Wasteslag	0,72	29,70	51,72	2,55

The data in table 4 show that the copper content in waste slag during the operation of the Vanyukov furnace with the loading of reduced converter slag is 0.58 % - 0.72 %. These figures do not exceed the data on the content of copper in the dump slags of the Vanyukov furnace, which operate without loading converter slags.

The practice of industrial tests has shown that there were no significant changes in the increase in the copper content in waste slags, as well as in the indicators of the smelting process of sulfide concentrate during the processing of solid-reduced converter slags of copper production in the Vanyukov furnace under the conditions of "Almalyk MMC" JSC.The missing heat in the Vanyukov furnace when loading the reduced slag in a cold state is replenished by loading clinker, which is not only a heat generator but also an additional raw material of precious metals. It should be noted on the basis of industrial tests, an increase in the loading of converter slag and clinker into the Vanyukov furnace contributes to an increase in the yield of copper, gold and silver in the matte.

Conclusion. As a result of the research on the development of a two-stage technology for the processing of converter slags with the involvement of technogenic raw materials in the form of clinker in the Vanyukov furnace, it was possible to achieve the reduction of the excess part of magnetite with carbon, and the extraction of copper and precious metals into matte reached 95 %. It was possible to deplete converter slags of copper production in terms of copper from 2.2-3.5 % to dump 0.58-0.72 %.

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Ключевые слова: сырье, отход, медь, шлак, восстановление, обеднение, магнетит, извлечение, клинкер.

В статье показаны исследования обогащения штейновой фазы медью и благородными металлами при плавке сульфидных медных концентратов в однозонной автогенной печи Ванюкова, с вовлечением в производство техногенных образований в виде конвертерного шлака и клинкера цинкового производства на медный завод АО «Алмалыкский ГМК». На основе разработанной двухэтапнойтехнологии переработки конвертерного шлака при плавке сульфидного концентратав печи Ванюкова с использованием восстановительных компонентов клинкера цинкового производства содержащего более 50 % восстановительных элементов в виде металлического железа и углерода, а также золота 2,7 -3,5 г/т и серебра 160-250 г/т степень извлечения в черновую медь составила 95 %.

Kalit so‘zlar: xomashyo, chiqindi, mis, shlak, qaytatiklash, tugatish, magnetit, ekstraksiya, klinker.

Maqolada birzonali avtogen Vanyukov pechida sulfidli mis boyitmalarini eritish jarayonida «Olmaliq KMK» AJ mis zavodiga konvertor shlaklari va rux ishlab chiqarishning klinker texnogen birikmalarni ishlab chiqarishga joriy etib shteyn fazani mis va nodir metallar bilan boyitish bo'yicha tadqiqotlar ko'rsatilgan.Vanyukov pechida sulfidli boyitmalarni eritish jarayonida 50 % dan ortiq metalli temir va uglerod tiklovchi elementlardan tashkil topkan, shuningdek oltin 2,7-3,5 g/t va kumush 160-250 g/t o'z ichiga olgan rux ishlab chiqarish klinkerdan foydalangan holda konvertor shlaklarini qayta ishlashning ikki bosqichli ishlab chiqilgan texnologiyasi asosida homaki misga nodir metallarni o ‘tish darajasi 95 % ni tashkil etdi.

Key words: raw materials, waste, copper, slag, recovery, depletion, magnetite, extraction, clinker.

The article shows studies of the enrichment of the matte phase with copper and noble metals during the smelting of sulfide copper concentrates in the Vanyukov single-zone autogenous furnace, with the involvement in the production of technogenic formations in the form of converter slag and zinc production clinker at the copper plant of “Almalyk MMC” JSC.Based on the developed two-stage technology for converter slag processing during the smelting of sulphide concentrate in the Vanyukov furnace using reducing components of zinc production clinker containing more than 50 % of reducing elements in the form of metallic iron and carbon, as well as gold 2.7-3.5 g/t and silver 160-250 g/t, the degree of extraction into blister copper was 95 %.