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Development of Technology for Extraction of Tungsten-Containing Industrial Product from Slurry Cakes.

Mutalova M.A., Khasanov A.A.,Masidikov E.M., Ibragimov I.S.

Associate lecturers and assistant of the department "Mining" of the Almalyk branch of the Tashkent State Technical University named after Islam Karimov, Almalyk, Uzbekistan.

ABSTRACT: In modern conditions, requiring the expansion of the raw material base of the Republic of Uzbekistan, ore production increases and at the same time changes the quality of the extracted minerals. First of all, the content of the useful component decreases in them. Therefore, there is a development of technology for processing man-made waste of mining production with the extraction of useful components from them. In the article the combined technological scheme of extraction of tungsten industrial product with the content of WO3 to 25-30% from technogenic wastes of NPO JSC “Almalyk MMC” is offered.

KEYWORDS: autoclave-soda leaching, tungsten industrial product, cake, scheelite, tailings, screw separator, concentration table.

I.INTRODUCTION

Continuous improvement of technology of processing of mineral raw materials, application of more progressive methods and receptions, a choice of optimum technological schemes allow to allocate economically justified from earlier unpromising wastes profitable to processing.

In addition, technogenic waste occupies about 12 thousand hectares of land, which includes well-developed arable land, urban area, rain-fed pasture lands. The natural landscape changes and peculiar forms of relief are formed, represented by dumps, tailing dumps filled with mass technogenic waste, negatively affecting the natural environment. In the area of tailing dumps, the chemical composition of soils changes, easily soluble compounds are washed away, groundwater is polluted and thus irreparable harm is done to nature. Huge amounts of money are spent annually on the maintenance and storage of these wastes.

II.SIGNIFICANCE OF THE SYSTEM

The problem of processing waste tailings of concentrators and extraction of useful components from them with their subsequent use as secondary raw materials is one of the most urgent.

The basis of waste-free technology is the development and implementation of fundamentally new technological processes that exclude any types of waste, various waste-free technological schemes and water cycles based on effective methods of purification, as well as the widespread use of waste as secondary raw materials.

An important problem of creating a waste-free technology is its organizational principles, where a certain role is played by the choice of directions, the structure of units. In this regard, there is a positive experience of a number of enrichment enterprises, both foreign countries and CIS countries.

Wide coverage of scientific and technical developments, their theoretical analysis, as well as generalization of the experience of advanced enterprises for processing man-made waste play an important role in the problem of creating an improved waste-free technology in non-ferrous metallurgy.

Finally, the useful processing of man-made waste makes it possible to free up the territory occupied by dumps, or at least not to expand it to indefinite limits, that is, it improves the environmental situation in and around the dump zone.

III. LITERATURE SURVEY

After processing of tungsten concentrates by autoclave-soda leaching, tungsten containing dumps were formed at Almalyk MMC NPO. A method for the complex processing of tailings enrichment of tungsten ores,

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including their classification into small and large fractions, screw separation of the fine fraction to obtain a tungsten product, its re-cleaning and finishing to obtain a high-grade tungsten concentrate, a sulfide-containing product and secondary dump tails characterized in that the tungsten product obtained after screw separation is subjected to re-cleaning on a screw separator to obtain a high-grade conditioned tungsten concentrate and a sulfide-containing product, tails spiral separator and shaking table were combined and subjected to concentration, obtained after condensation drain serves on the classification of the tailings of a tungsten containing ore, and the condensed product was subjected to enrichment on screw separator receiving the secondary tailings, and a tungsten product which is sent for cleaning out.

A method for extracting tungsten from gravitational enrichment tails is known. Tails of gravitational enrichment are further ground, de-mudded in a classifier, the Sands of which are divided into hydraulic classifiers. The obtained classes are enriched separately on concentration tables. Coarse-grained tails are returned to the grinding cycle, and thin tails are thickened and re-enriched on slurry tables to obtain the finished concentrate, industrial product coming to the re-grinding and tails directed to flotation. Concentrate main flotation is subjected to the same cleaning out. The source ore contains 0.3-0.5% WO3; tungsten recovery reaches 97%, with about 70% of tungsten recovered by flotation. However, the tungsten content in the flotation concentrate is low (about 10% WO3).

IV. METHODOLOGY

The disadvantages of the technological scheme of processing of gravitational enrichment tails are the high load in the head of the process on the enrichment operation on the concentration tables, multi-operation, low quality of the resulting concentrate. A method for treating scheelite-containing tails is known, which includes the following processes - introduction of pulp into the reactor, filtration of pulp by screening to remove various foreign materials, subsequent separation of pulp by screw separation, thickening and dehydration of non-metallic minerals to obtain cake, drying cake in a rotary dryer, crushing of dry cake using a hammer crusher operating in a closed cycle with a screen, separation of crushed minerals by means of a "micron" separator into fractions of light and coarse grains, as well as magnetic separation of coarse-grained fractions producing magnetic minerals and non-magnetic fraction containing scheelite. The disadvantage of this method is multi-operation, the use of energy-intensive drying of wet cake.

A method is known to recover tungsten from the tailings of the Ingichka mine concentrator. The method includes the preparation of the pulp and its deslimation in a hydrocyclone, the subsequent separation of the deslimed pulp on a cone separator, two-stage cleaning of the cone separator concentrate on concentration tables to obtain a concentrate containing 20.6% WO3, with an average extraction of 29.06%. The disadvantages of this method is the low quality of the concentrate obtained and the insufficiently high extraction of WO3.

Complex processing of tails of Ingichkin concentrator begins with classification of tails on small and large fractions with allocation of secondary dump tails in the form of large fraction. The fine fraction of the tails is subjected to screw separation. This allows for a correspondingly sharp reduction in the burden on subsequent operations, capital costs and operating costs. The resulting tungsten product is subjected to re-cleaning on a screw separator to obtain a rough concentrate and tails. The rough concentrate was subjected to a lapping at a concentration table with getting a tungsten gravity concentrate and tails.

The tails of the concentration table and the screw separator are combined and subjected to thickening, in a thickener, mechanical classifier, hydrocyclone or other apparatus. The thickening drain is fed to the classification stage at the head of the technological scheme, and the condensed product is subjected to enrichment on a screw separator to obtain secondary dump tails and a tungsten product, which is directed to re-cleaning.

Gravity tungsten concentrate is brought by flotation to a high-grade conditioned tungsten concentrate to obtain a sulfide-containing product.

The resulting sulfide-containing product is processed in a known way, for example, used to obtain sulfuric acid and sulfur, and is also used as a corrective additive in the production of cements.

Enrichment of dump cakes by one gravitational method of enrichment does not give positive results. From this point of view, the study of the possibility of combined methods of extraction of tungsten from sludge dumps is relevant.

Scheelite is the second most common mineral forming deposits of tungsten ores. Common satellites of tungsten minerals in deposits are cassiterite, molybdenum, bismuth Shine, native bismuth, chalcopyrite, chalcosine, pyrite, arsenopyrite, Galena, etc. harmful impurities include oxides of manganese, silicic acid, phosphorus, sulfur, arsenic, tin, copper, molybdenum, etc.

Finely interspersed scheelite ores with a low content of three tungsten oxides are enriched by flotation, and with a large mineral impregnation, enrichment can be carried out by combined methods, jigging, concentration on gravity tables and flotation. For the enrichment of tungsten cake, we selected a combined scheme consisting of gravity and flotation enrichment methods.

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The circuit diagram of the apparatus consists of a screw separator, a concentration table and a flotation machine. 5 samples weighing 50 kg were selected. the Chemical composition of dump cakes is given in table. 1.

Table 1.

Chemical composition of dump cakes

№	Name of components	Contents %
1	Silica	38-45
2	Alumina	5-8
3	Calcium oxide	17-30
4	Potassium oxide	1-2
5	Tungsten trioxide	1-1, 5
6	Common iron	5-12
7	Sulfur	1-2
8	Carbon dioxide	14-18
9	Phosphorus	0.04-0.06

Prepared pulp, the ratio T: W=1: 4. The first series of experiments were carried out only by the gravitational method, i.e. on a screw separator and on a concentration table. A tungsten industrial product containing about 10% scheelite was obtained. Further, the obtained industrial product was subjected to a flotation method of enrichment according to the Petrov method.

V. EXPERIMENTAL RESULTS

Hydrochloric acid to pH-3-4 was used as a medium regulator, butyl xanthate (100-120 g/t) was used as a collector, and t – 92 was used as a foaming agent. For finishing of rough sheelite concentrate the method including steaming at the high content of solid in 2-3% solution of liquid glass within 60 minutes at temperature 80-900 with the subsequent clearing is developed.

The use of the combined method can significantly increase the extraction of tungsten oxide. Scheelite is an easily flotation mineral characterized by high sludge content. The extraction of scheelite increases significantly with the flotation method of enrichment compared to gravity.

Thus, the tungsten product obtained after screw separation is subjected to re-cleaning on a screw separator to obtain a rough tungsten industrial product from the dump cakes of NPO Almalyk MMC JSC (the scheme is shown in Fig.1).

Flotation of scheelite from ores with calcium-containing minerals (calcite, fluorite, Apatite) is carried out by anionic fatty acid collectors. Separation of scheelite from calcium-containing minerals is possible only with the use of regulators such as liquid glass, sodium silicofluoride, soda.

The content of phosphorus, which is part of Apatite, in scheelite concentrates should not exceed hundredths of a percent. Therefore, Apatite as well as barite must be removed from the concentrate. The most effective suppression of flotation of calcium-containing minerals by Petrov - steaming pulp with liquid glass.

The most difficult is suppressed by the method of Petrov Apatite, so it is removed by leaching a solution of hydrochloric acid at a concentration of 35-45 g/l.

The resulting rough tungsten industrial product is subjected to finishing on the concentration table and sent to flotation. After two scouring operations it is possible to obtain tungsten industrial product with a content of tungsten trioxide up to 25-30%.

Below is the proposed technological scheme of enrichment of dump cakes NGO JSC "Almalyk MMC".

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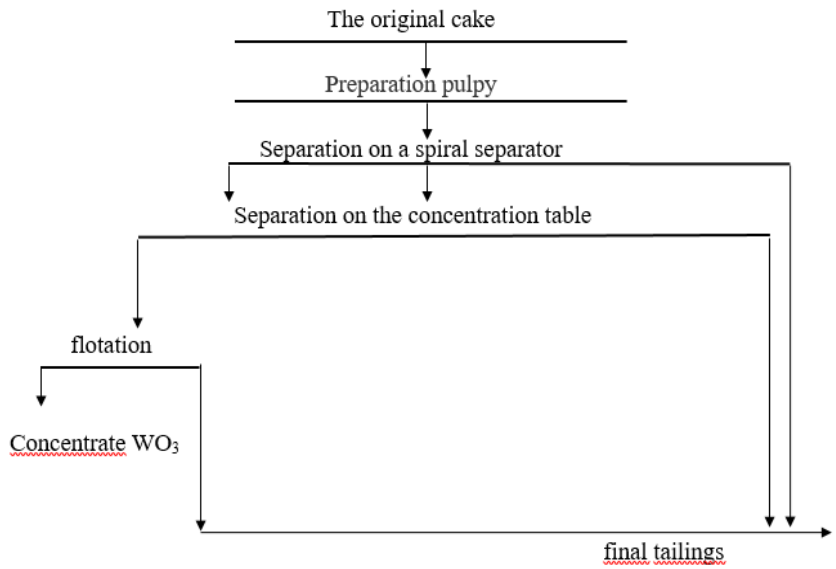

Rice. 1-the proposed technological scheme of enrichment of dump cakes NGO JSC "Almalyk MMC".

Methodology

For enrichment of tungsten cake the combined scheme consisting of gravitational and flotation method of enrichment is chosen. Below is the sequence of work on the extraction of tungsten industrial product from the dump cake:

1.The preparation of the slurry, relations W:T=1:4.

2.Selection of equipment for laboratory research.

Five samples weighing 50 kg were taken.

VI. CONCLUSION

The first series of experiments was carried out only by the gravitational method, i.e. on a screw separator with clearing and on the concentration table. The results of chemical analysis showed that the obtained industrial product contains 10-12% WO3.

A second series of experiments will be scheduled for a combined flowsheet, i.e. pulp is fed to the screw separator, screw separator concentrate is fed to shaking table. The concentrate containing about 10% WO3 enters the flotation. To obtain an acidic medium, we add concentrated hydrochloric acid, butyl xanthogenate is used as a collector and T-92 as a foaming agent. The use of the combined method can significantly increase the extraction of tungsten oxide.

Results

In the course of laboratory experiments on the extraction of tungsten industrial product from the cake by the gravitational method, a tungsten product containing 10-11% WO3 was obtained.

After enrichment of the cake by the combined method, it is possible to obtain tungsten industrial product with a content of WO3 up to 25-30% .

The combined method consists of enrichment of the cake in a spiral separator with a cleaning out. The resulting product is enriched on the concentration table. The concentrate of the concentration table is sent to flotation.

The main mineral is scheelite, and it is considered to be easily flotation. The extraction of scheelite increases significantly with the flotation method of enrichment. Oleic acid was used as a collector.

Conclusion

When enriching cake NPO JSC "Almalyk MMC" gravity method on screw separators with clearing and concentration table was obtained tungsten industrial product containing 10-11% WO3. In preparation of cake for the combined scheme, i.e., the initial enrichment on the spiral separator and shaking table followed by flotation of the obtained middlings, after the main control flotation and roughing operations possible to obtain a tungsten middlings containing 25-30% WO3.

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AUTHOR'S BIOGRAPHY

№	No. full Name place of work, position, academic degree and title	Photo
1	Mutalova M.A., lecturer of the Department "Mining" of the Almalyk branch of the Tashkent State Technical University named after Islam Karimov	
2	Khasanov A.A., lecturer of the Department "Mining" of the Almalyk branch of the Tashkent State Technical University named after Islam Karimov	
3	Masidikov E.M., lecturer of the Department "Metallurgy" of the Almalyk branch of the Tashkent State Technical University named after Islam Karimov	
4	IbragimovI.S., assistant of the Department "Mining" of the Almalyk branch of the Tashkent State Technical University named after Islam Karimov