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STUDY OF THE TECHNOLOGY FOR EXTRACTING TUNGSTEN IN THE FORM OF A SEMI-FINISHED PRODUCT AND METALLIC FORM FROM INDUSTRIAL WASTE



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Abstract. *The article outlines the problems associated with the occurrence of man-made waste and the priority tasks for solving them, analysis of the technology for the enrichment of tungsten-containing ores and their waste, study of the chemical and mineralogical composition of man-made tungsten-containing waste from the Ingichki mine.*

Keywords: *mineral, tungsten, mine, loss and depletion of mineral resources, enrichment, metallurgical industry, technogenic deposits, stale tailings, processing, environmental safety, efficiency, economy.*

ИЗУЧЕНИЕ ТЕХНОЛОГИИ ИЗВЛЕЧЕНИЯ ВОЛЬФРАМА В ВИДЕ ПОЛУФАБРИКАТА И МЕТАЛЛИЧЕСКОМ ВИДЕ ИЗ ТЕХНОГЕННЫХ ОТХОДОВ

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Аннотация. *В статье изложены проблемы от возникновения техногенных отходов и приоритетные задачи их решения, анализ технологии обогащения вольфрам содержащих руд и их отходов, изучение химического и минералогического состава техногенных вольфрам содержащих отходов рудника Ингички.*

Ключевые слова: *Полезное ископаемое, минерал, вольфрам, рудник, потери и истощение минеральных ресурсов, обогащение, металлургическая отрасль, техногенные отложения, лежалые хвосты, переработка, экологическая безопасность, эффективность, экономичность.*

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SANOAT CHIQINDILARIDAN YARIM TAYYOR MAHSULOT VA METALL SHAKLDA VOLFRAM OLISH TEXNOLOGIYASINI O‘RGANISH

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Annotatsiya. *Maqolada texnogen chiqindilarning paydo bo'lishi bilan bog'liq muammolar va ularni hal qilishning ustuvor vazifalari, volfram o'z ichiga olgan rudalar va ularning chiqindilarini boyitish texnologiyasini tahlil qilish, texnogen volframning kimyoviy va mineralogik tarkibini o'rganish - Ingichki konidan chiqadigan chiqindilar misolida.*
Kalit so'zlar: *Foydali qazilma, mineral, volfram, kon, foydali qazilmalarning yo'qolishi va kamayishi, boyitish, metallurgiya sanoati, texnogen konlar, eskirgan qoldiqlar, qayta ishlash, ekologik xavfsizlik, samaradorlik, tejamkorlik.*

Introduction. In the world, despite the expected commissioning of new deposits, the increase in ore reserves will lag behind the growing needs of industry. As a result, much attention is paid not only to maximizing the degree of utilization of continental deposits, but also to the development of secondary raw materials, technogenic deposits, as well as ore reserves of the shelves and the ocean floor. All this indicates that at present, the comprehensive increase in the complexity of the use of subsoil through the creation of low-waste and waste-free processing of mineral raw materials is becoming extremely important [1; p.90].

The concept for the development of the metallurgical industry of Uzbekistan defines the tasks and priority directions for the development of non-ferrous metallurgy by the development and implementation of innovative technologies both in primary production and enrichment, and from technogenic secondary raw materials, allowing the extraction of valuable components into a commercial product - precious, rare and rare earth metals, the creation of new technologies and production.

This task has several priorities. Firstly, metal extracted from recycled materials is much cheaper than metal extracted from ore mined from the ground due to a number of reductions in technological processing steps. Secondly, after extracting metals from waste, the latter can be usefully recycled into finished products, a waste-free technology is created, while at the same time the issue of environmental protection is resolved [2; p.94-104].

Currently, the Republic of Uzbekistan has accumulated more than 2.3 billion tons of waste from non-ferrous metallurgy enterprises. Consequently, the involvement of tailings from processing plants and waste from metallurgical plants into production is an urgent task for the mining and metallurgical complex of the Republic and environmental protection.

An important problem in creating a waste-free technology is its organizational and technical principles, where the

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development of processing methods and the choice of equipment, the structure of departments and economic efficiency play an important role. In this aspect, there are positive experiences of a number of mining and processing enterprises, both in foreign countries and in the countries of the Commonwealth of Independent States [3; p.92-95].

Literature Analysis and Methods. A large number of studies by F.E. Apeltsin, V.F. Barabanov, O.V. Bryzgalin, I.V. Buldakov, V.K. Denisenko, Yu.G. Ivanov, G.F. Ivanova, V. are devoted to these issues. M. Izoitko, G. R. Kolonina and G. P. Shironosova, O. V. Kononov, S. A. Korenbaum, M. A. Kudrina, S. F. Lugova, I. E. Maksimyuk, D. O. Ontoeva, M.M. Povilaitis, V.A. Popova and V. I. Popova, M. B. Rafaleon, D. V. Rundkvista, V. I. Sotnikova, L. V. Syritso, L. V. Chernysheva, I I. Chetyrbotskaya, N. I. Shumskaya, A. D. Shcheglov, G. N. Shcherba and many others. On the other hand, research by L.A. Barsky, V.Z. Bliskovsky, A.I. Ginzburg, Yu.G. Grekulova, N.V. Ivanov, O.P. Ivanov, G.A. Kots, Yu.P Kushparenko, V.I. Matias, G.A. Mitenkova, B.I. Pirogov, G.S. Porotova, G.A. Sidorenko, V.I. Revnivtsev, S.F. Chernopyatov and many others, it has been established that the chemical composition of minerals, the concentration of micro-impurities, some physical properties are important when assessing the quality of mineral raw materials and their determination, along with the study of surface properties, defectiveness of crystals, characteristics of ore associations, is the main thing when choosing methods of ore preparation and enrichment, methods of controlling technological processes.

Discussions. To process the materials under study, they decided to test a number of technological schemes and enrichment methods in order to identify the optimal option for the layout of apparatus circuit diagrams and modes of conducting technological processes. The following were chosen as enrichment methods and apparatus circuit diagrams: conducting experiments on the enrichment of stale tailings on a screw separator with cleaning and on a concentration table with two cleanings; experiments using the gravity method in combination with flotation according to the Petrov method; experiments using the gravity method in combination with a jigging machine with cleaning and control jigging, then enrichment of the product on a concentration table, preferably with two cleanings, also replacing the jigging machine with a screw separator [4; p.12334-12338].

When enriching materials with finer dissemination of minerals, processes and schemes become more complex with the addition of reverse flotation, gravity flotation, magnetic and electrical separation, roasting and chemical processing methods.

Finely disseminated scheelite ores with low WO_3 content are enriched by flotation, and with large dissemination of the mineral, enrichment can be carried out by combined methods, jigging, concentration on tables and flotation. The finished product of the processing plant is scheelite concentrate grade KSh-4 for the production of hard alloys [5; p.57-61].

At the initial stage, the enrichment of ores from the Ingichkinsky mine was carried out by flotation at a pilot plant with an ore processing capacity of up to 100 - 150 tons per year. As a result of its activities, tailings dump No. 1 with a total volume of 3.6

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million tons was reclaimed. tails. In 1976, the main enrichment plant was put into operation, with a capacity of up to 500 thousand tons of ore for feedstock, which operated until 1996. As a result of its activities, tailings dump No. 2 was formed, facilitating the storage of about 12 million tons of stale tailings.

The total reserves of stale tailings according to plant accounting data are estimated: - total quantity 14662 thousand tons, including in the small tailings dump - 3614 thousand tons, in the large tailings dump - 11048 thousand tons.

The average content in stale tailings is 0.06% WO_3.

There is a known method for additional extraction of tungsten from the waste tailings of the processing plant of the Ingichkinsky mine [7; p.47-54], which includes:

- ✓ preparation of pulp and its desliming in a hydrocyclone (removal class - 0.05 mm);
- ✓ subsequent separation of the deslimed pulp using a cone separator;
- ✓ two-stage re-cleaning of the cone separator concentrate on concentration tables to obtain a concentrate containing 20.6% WO_3, with an average recovery of 29.06%.

The disadvantages of this method are the low quality of the resulting concentrate and insufficiently high WO_3 extraction.

The technology for extracting tungsten from stale tailings using this method includes:

- operations for obtaining rough tungsten containing concentrate and middling product, gold-containing product and secondary tailings using gravitational methods of wet enrichment - screw and centrifugal separation - and subsequent finishing of the resulting rough concentrate and middling product using gravitational (centrifugal) enrichment;
- and magnetic separation to produce conditioned tungsten concentrate containing 62.7% WO3 with a recovery of 49.9% WO_3.

In this case, the centrifugal separation tailings and the non-magnetic fraction are sent to secondary tailings, the total yield of which at the stage of finishing the rough tungsten concentrate is 3.28% with a content of 2.1% WO_3.

The disadvantages of this method are the multi-operational nature of the technological process, which includes 6 classification operations, 2 additional grinding operations, as well as 5 centrifugal and 3 magnetic separation operations using relatively expensive equipment. At the same time, finishing rough tungsten concentrate to standard condition is associated with the production of secondary waste tailings with a relatively high tungsten content (2.1% WO_3).

Conclusion. The article provides a solution to a pressing scientific and production problem: scientifically substantiated, developed and, to a certain extent, implemented effective technological methods for extracting tungsten from the stale tailings of the Ingichkinsky enrichment plant.

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