METHODS FOR DETERMINING THE COMPOSITION OF TUNGSTEN WASTE AT JSC “UZBEKISTAN TECHNOLOGICAL METALS PLANT”

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Annotation: This article focuses on methods for determining the composition of tungsten waste at JSC "Uzbekistan Technological Metals Plant." Tungsten is crucial in industry due to its high melting point and mechanical properties. However, waste generated from tungsten processing can lead to environmental issues. The article examines modern chemical and physical methods for waste analysis, including spectroscopy, spectral, chemical, mineralogical, and phase analysis techniques. These methods are used to determine the chemical composition and physical properties of tungsten waste, as well as their significance in processing procedures.

Keywords: Tungsten waste, chemical composition, analysis methods, spectroscopy, electron microscopy, zero-waste technologies.

Аннотация: Данная статья посвящена методам определения состава вольфрамовых отходов на АО "Узбекский завод технологических металлов". Вольфрам имеет решающее значение в промышленности из-за его высокой температуры плавления и механических свойств. Однако отходы, образующиеся при переработке вольфрама, могут привести к экологическим проблемам. В статье рассматриваются современные химические и физические методы анализа отходов, включая спектроскопию, спектральные, химические, минералогические и фазовые методы анализа. Эти методы используются для определения химического состава и физических свойств вольфрамовых отходов, а также их значимости для процессов переработки.

Ключевые слова: Вольфрамовые отходы, химический состав, методы анализа, спектроскопия, электронная микроскопия, безотходные технологии.

Annotatsiya: ushbu maqola "O'zbekiston texnologik metallar zavodi" AJda volfram chiqindilari tarkibini aniqlash usullariga bag'ishlangan."Volfram yuqori erish nuqtasi va mexanik xususiyatlari tufayli sanoatda juda muhimdir. Biroq, volframni qayta ishlash natijasida hosil bo'lgan chiqindilar ekologik muammolarga olib kelishi mumkin. Maqolada chiqindilarni tahlil qilishning zamonaviy kimyoviy

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va fizik usullari, shu jumladan spektroskopiya, spektral, kimyoviy, mineralogik va fazali tahlil usullari ko'rib chiqilgan. Ushbu usullar volfram chiqindilarining kimyoviy tarkibi va fizik xususiyatlarini, shuningdek ularni qayta ishlash protseduralaridagi ahamiyatini aniqlash uchun ishlatiladi.

Kalit so'zlar: volfram chiqindilari, kimyoviy tarkibi, tahlil usullari, spektroskopiya, elektron mikroskopiya, chiqindisiz texnologiyalar.

Introduction

The Uzbekistan Technological Metals Plant holds a leading position in the production and processing of tungsten. Tungsten waste primarily consists of byproducts generated during manufacturing processes[1]. Determining the composition of these wastes is essential for optimizing waste management and recycling procedures. This article examines methods for analyzing the composition of tungsten waste from JSC Uzbekistan Technological Metals Plant. Tungsten, with its superior mechanical properties and high melting point, plays a crucial role in numerous industrial sectors. Waste analysis techniques are vital in resource recycling and ensuring environmental safety[2].

Currently, global industrial processes are undergoing rapid development worldwide, leading to an increased demand for non-ferrous and rare metals, including tungsten. According to statistics, over 10 billion tons of minerals are extracted annually. As a result, the issues of improving existing technologies in the metallurgical industry and making them more environmentally friendly are becoming increasingly urgent[3].

Neutralization of technogenic waste is a complex scientific and technical problem that requires solving two main tasks. The first involves significantly reducing the concentration of the complex of basic elements to obtain an environmentally safe solid product that can be used as a raw material for the production of construction materials. The second entails concentrating this complex of elements and subsequently isolating from them a group of economically valuable metals (W, Mo, Ta, Nb, Cu, Co, Ni, Mn, and others) that have market value[4].

Literature Review

Information on “Chemical and Physical Properties of Tungsten”, its industrial importance, and its presence in waste is provided. The authors emphasize tungsten's properties such as high melting point and hardness, which explains its applications in industrial processes. Various methods of waste analysis, including spectroscopy, mass spectrometry, and other analytical techniques, are described in detail. The advantages and limitations of each method are highlighted, along with information on how they are applied in the analysis of tungsten waste[5]. Methods

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such as atomic emission spectroscopy, mass spectrometry, infrared spectroscopy, and X-ray fluorescence are elaborated upon. Information is presented on the operating principle of each method and its role in detecting tungsten in waste materials.

Research Methodology

Selective smelting of cakes is carried out at a temperature of 220°C and with a large amount of calcined soda (250.0-300.0% higher than stoichiometric requirements). In this process, 96.0-97.0% of tungsten is extracted into the solution, while 1.5-2.0% WO_3 remains in the solid waste. The extraction of 96.0-97.0% tungsten into the solution is achieved. From the purified solution, tungsten is extracted using VP-14K ion exchange resin, and from the desorbate, ammonium paratungstate (APW) salts are crystallized, from which high-purity tungsten trioxide is obtained[6].

The proportion of non-extracted components in the cakes of JSC "Uzbekistan Technological Metals Plant" in relation to the initial ore content is as follows (%): 0.05-1.5 WO_3; 38-45 SiO_2; 5-8 Al_2O_3; 17-30 CaO; 1.2 K_2O; 0.04-0.06 P; 5-12 Fe; 1-S.

Experimental tests were conducted to study the composition of the cake. In order to investigate the possibility of completely extracting valuable components from the accumulated technogenic raw materials, waste samples from technogenic zones were analyzed to assess the prospects for developing Waste Storage Facility No. 2. Furthermore, the research results revealed high concentrations of silicon, calcium, aluminum, and iron oxides in the deposited waste. Regular samples were analyzed for WO_3 and S (II) content. Composite samples were used for mineralogical, chemical, phase, and sieve analyses. According to the results of spectral semi-quantitative analysis of the analytical sample, the main valuable component - W and secondary components - Pb, Zn, Cu, and Mo were identified. The content of WO_3 in the form of scheelite is relatively consistent across all size classes of various tailings, averaging 0.042-0.044%. The study of the granulometric composition of the tailings revealed that they primarily consist of fine-grained fractions, with the -0.25+0.125 mm size class accounting for 30% of the material[7].

The majority of the cake sample material (~58%) has a size of 1+0.25 mm, while 17% corresponds to both large (-3+1 mm) and fine (-0.25+0.1 mm) fractions. The proportion of material with a size of -0.1 mm is approximately 8%, of which half (4.13%) belongs to the -0.044+0 mm slurry fraction. For tungsten, there is a slight variation in content (0.04-0.05%) across the size fractions from -3+1 mm to -0.25+0.1 mm, with a sharp increase (up to 0.38%) in the -0.1+0.044 mm size

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fraction. In the -0.044+0 mm slurry fraction, the tungsten content decreases to 0.19%. That is, 25.28% of tungsten is concentrated in the -0.1+0.044 mm fraction, which has a yield of approximately 4%, while 37.58% is concentrated in the -0.1+0 mm fraction, with a yield of 8.37%. The results of analyzing data on the distribution of hubnerite and scheelite in mineral raw materials of initial size and those ground to -0.5 mm are presented in Table 1.

Table 1.

Distribution of hubnerite and scheelite grains and their intergrowths across size fractions of the initial and crushed mineral raw materials.

Size classes,mm	Distribution, %			
	Gubnerite		Sheelit	
	Free particle	Connected places	Free particle	Adjacent areas
(-5 + 0 mm)				
-5 +3	-	-	-	-
-3 +1	36.1	63.9	37.2	62.8
-1 +0.5	53.6	46.4	56.8	43.2
-0.5 +0.25	79.2	20.8	79.2	20.8
-0.25 +0.125	88.1	11.9	90.1	9.9
-0.125 +0.063	93.6	6.4	93.0	7.0
-0.063 +0	96.0	4.0	97.0	3.0
Quantity	62.8	37.2	64.5	35.5

After desliming the ore, it was concluded that classification at 0.1 mm size and separate enrichment of the obtained classes are necessary. For the coarse fraction, the following steps are required: 1) separating free grains into the initial concentrate, 2) additional grinding of larger tailings, desliming, combining with the 0.1+0 mm deslimed fraction of the initial mineral raw material, and gravitational enrichment to extract fine scheelite grains into the intermediate product.

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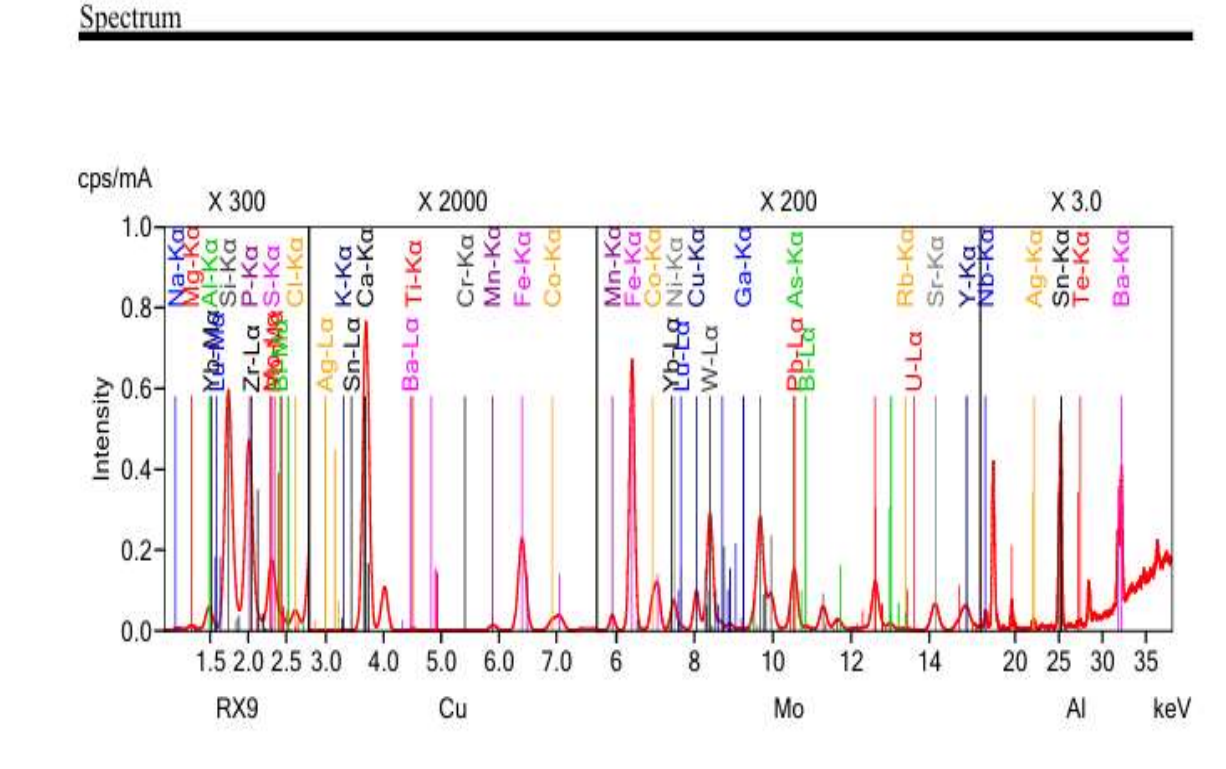


Figure 1. Results of EDXRF (Energy Dispersive X-ray Fluorescence) spectrometer analysis.

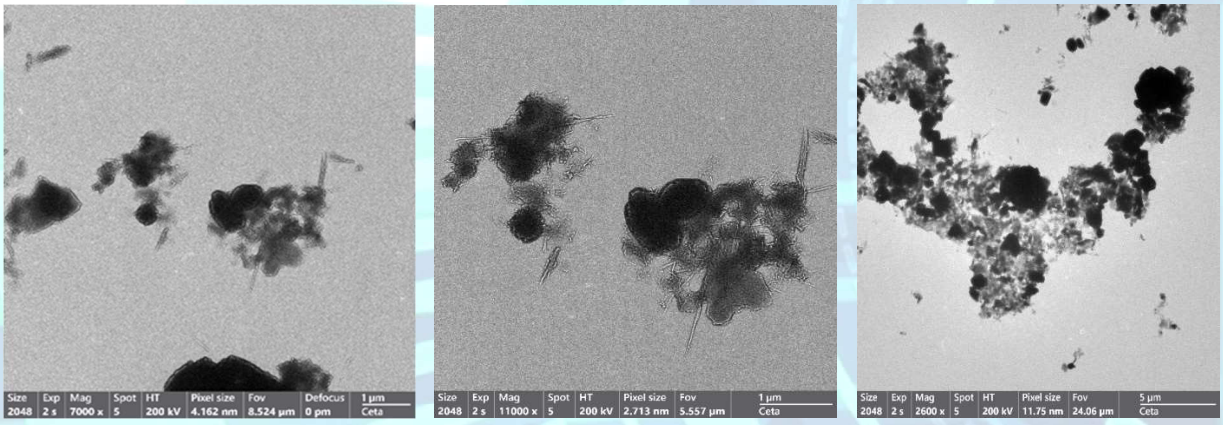


Figure 2. The EDS spectrum is a graph that shows the intensity (counts) relative to the energy of X-rays. (The EDS spectrum is a graph displaying the intensity (counts) relative to X-ray energy. Each peak corresponds to a specific element.)

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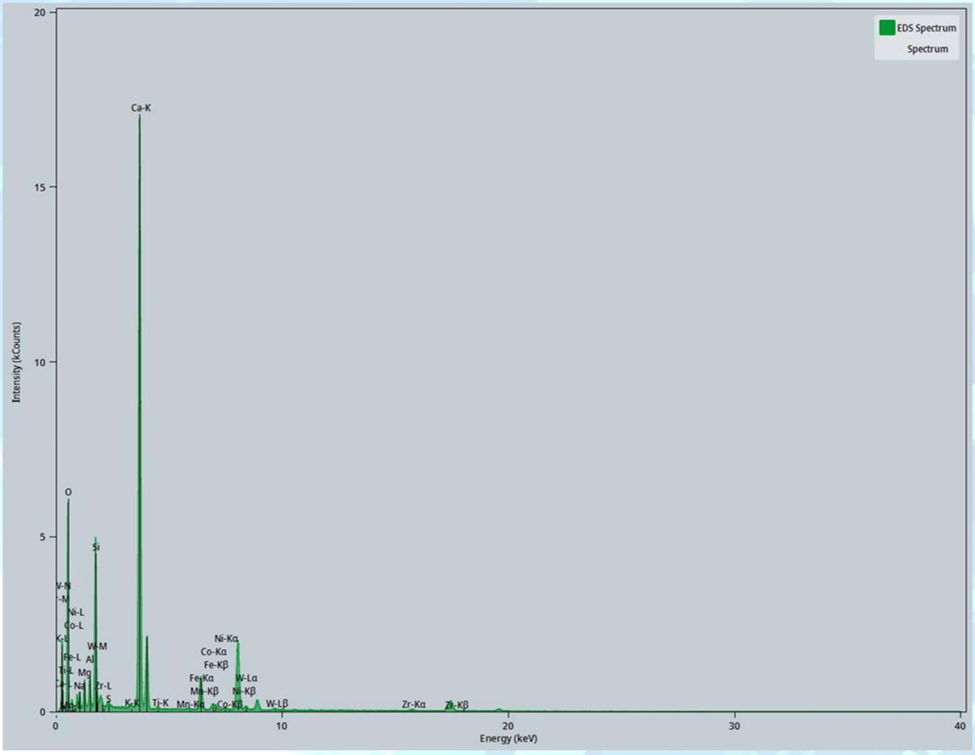


Figure 3. Identified regions of the cake sample (a,b) and its energy-dispersive X-ray spectroscopy (c)

EDXRF (Energy Dispersive X-ray Fluorescence) spectrometry is a method that uses the X-ray fluorescence effect to identify and quantitatively analyze elements in a material. In this method, X-rays are directed at the sample, causing each element to emit secondary X-rays (fluorescence) of specific energy. These rays are then detected by a detector, which determines the presence and quantity of each element. The X-ray source sends X-rays to the sample. The fluorescence effect occurs when each element radiates at its characteristic energy. An energy-dispersive detector identifies these rays. In spectral analysis, energy peaks are determined for each element, and qualitative and quantitative analysis of the elements is obtained using software.

Conclusion

Methods for determining the composition of tungsten waste at JSC "Uzbekistan Technological Metals Plant" have significant scientific and practical importance. Tungsten, due to its high hardness and heat resistance, is widely used in industry; therefore, accurate knowledge of its waste composition is crucial for efficient resource management and environmental protection.

Modern analytical methods, including spectroscopy and mass spectrometry, are effective in identifying the presence of tungsten and other elements in waste analysis. With the help of these methods, it is possible to determine the concentration of tungsten in waste, as well as assess its environmental impact.In addition, zero-waste technologies and recycling processes help reduce the

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environmental risks associated with tungsten waste. All these factors play a crucial role in optimizing the management and processing of tungsten waste at JSC "Uzbekistan Technological Metals Combine."

In the future, further refinement of methods for determining the composition of tungsten waste and the implementation of innovative approaches will be of great importance in increasing the efficiency of resource utilization and addressing environmental issues. This, in turn, will have a positive impact on Uzbekistan's industrial development and environmental protection.

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