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PERSPECTIVITY OF BLACK SHALE ORE PROCESSING WITH THE INCIDENTAL EXTRACTION OF RARE AND RARE EARTH ELEMENTS IN THE REPUBLIC OF UZBEKISTAN

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Abstract. A fundamental approach to the development of theoretical foundations and the creation of a method for the complex extraction of rare metals (vanadium, uranium, molybdenum, rare earth elements) from black shale ores has been undertaken repeatedly. The proposed methods for processing this type of ore in the republic are based on the use of a hydrometallurgical enrichment method, which will provide a number of valuable components to the Republic of Uzbekistan.

The purpose of the research. Study of the potential of processing black shale ores to obtain non-ferrous, rare metals and rare earth elements.

Key words: REE, PRC, CIS, black shales, vanadium, molybdenum.

Rare and rare earth elements are key components of the most advanced materials and technologies. The steady interest in rare and rare earth elements is due to the wide range of their consumption in high-tech industries, increasing demand and a rather difficult situation on the world market. The unique properties of rare and rare earth elements serve as the basis for the implementation of advanced technologies in metallurgy, instrument making, mechanical engineering, radio electronics, chemical and defense industries, optics and other industries.

The global market for rare and rare earths is growing rapidly. Over the past 50 years, their volume has increased more than 25 times. The total demand for rare and rare earth elements in the last decade has been steadily increasing by 5-7% per year [1].

Mineral reserves of rare-earth metals are currently estimated at about 110 million tons, of which China accounts for about 50% of all reserves of rare-earth elements in the world [2]. The main resources of the PRC are concentrated in iron-niobium-rare earth deposits in the autonomous region of Inner Mongolia, bastnesite deposits in the north and deposits of ion-absorption ores in the south of the country. The country contains about 80% of all studied world reserves of rare-earth metals of the least abundant yttrium group.

The second place in terms of reserves of rare earth metals is occupied by the CIS countries (17%), where deposits of Russia prevail. Russian rare earths are concentrated mainly in the Lovozersk loparite deposit, apatites of the Kola Peninsula, and in complex deposits of Eastern Siberia [3].

In the new conditions of a market economy, it became objectively necessary for Uzbekistan to radically change the policy of its own provision with rare metal raw materials, incl. to create a state reserve of rare metals and their internal market. For several decades the republic has been extracting rare elements during the extraction of uranium and sulfide ores, while rarely metal mineralization of the lyophilic profile (Ta, Nb, Be, Li, Rb, Cs) remained unconventional until recently.

For the reproduction of its own mineral resource base of rare and rare-earth elements, it is necessary to conduct a number of technological studies to extract valuable components.

Currently, the Republic of Uzbekistan mines uranium from black shale deposits, which contain rare and rare earth elements. The complexity of processing such ores lies in the need for deep selective extraction of uranium and other valuable components. Existing technologies cannot always solve the problem of high and selective extraction of uranium and other rare and rare earth elements. One of the factors in the complexity of solving this problem is the tenacity of these ores for one or several rare and rare earth elements. Such ores of the Republic include black shale uranium-vanadium ores of deposits and ore occurrences Rudnoye, Ustuk, Boztau, etc., in which the vanadium content exceeds 4-6 times that of uranium. The content of the amount of REE is within 0.03%. Vanadium minerals of the deposit are diverse and resistant to processing. The uranium content

varies in ore bodies up to 0.1%. At the deposit, secondary uranium minerals are found in association with vanadates and other minerals. According to the performed chemical, mass spectroscopic analyzes, data were obtained containing the following valuable components: U, V, Mo, the amount of REE, Cu, etc.

The main commercial applications for vanadium are in steel, where its ability to form carbides imparts hardness and increased wear resistance to steel. Over 90% of all vanadium produced in the world is used for alloying steel, the remaining 10% is consumed by non-ferrous metallurgy, chemistry, etc. [4, 5].

The use of high-strength vanadium steels for oil and gas pipes, including boring, welded and riveted metal structures, is promising. Along with steel, vanadium additives also improve the properties of many non-ferrous and precious metals. Silver-vanadium alloys are used for the production of backup batteries. Bronzes and brass with the addition of 0.5% vanadium are used in the manufacture of complex parts [6].

According to the source [7], consumption of vanadium redox batteries (VRB) is expected to grow on the market. The VRB battery is a type of rechargeable flow battery that uses vanadium ions in various oxidation states to store chemical energy.

According to studies by Acumen Research and Consulting [8], the vanadium market is expected to grow by 6.6% over the forecast period 2020–2026. and the size of the global vanadium market by 2026 should be US $ 56 billion.

It should be noted that the complex processing of this type of ore will provide the republic with colored, rare and rare earth elements.

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