RESEARCH ON THE PROCESSING METHOD OF MAN-MADE TUNGSTEN WASTE CONTAINING COBALT

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https://doi.org/10.5281/zenodo.10396117

Abstract. *Production of finished products with high added value is important in the development of mining and metallurgical industry products. For this, the introduction of waste-free technology, the widespread use of waste-recycling and simple operational technological processes in an era of diminishing reserves of mineral resources is the demand of the present day.*
Keywords: *tungsten carbide, waste-free technology, nitric acid, sulfuric acid, hard alloy, cobalt powder, sodium nitrate , hydrogen, industrial waste.*

Introduction. Production of finished products with high added value is important in the development of mining and metallurgical industry products. For this, the introduction of waste-free technology, the widespread use of waste-recycling and simple operational technological processes in an era of diminishing reserves of mineral resources is the demand of the present day. [3,5,6]

Today, Uzbekistan is an importer of cobalt metal, and its demand is increasing day by day. Due to the need for cobalt metal and efficient use of production waste, it is important to separate this metal from man-made waste and direct it to the production of hard alloys.

The proposed method has the potential to meet the demand for imported cobalt metal. [1,2,4]

This article deals with extraction of cobalt metal from tungsten-containing industrial waste containing cobalt in the metallurgical production enterprises of “Almalyk Mining and Metallurgical Combine” JSC.

Methods and object of research.

Industrial waste containing tungsten containing cobalt was taken as a research object in the scientific production association for the production of rare metals and hard alloys “ Almalyk Mining and Metallurgical Combine” JSC. The research is based on the study of cobalt-containing tungsten waste, the choice of chemical reagents and metallurgical furnaces required for its solution. For this purpose, the composition of man-made waste existing in the scientific production association for the production of rare metals and hard alloys “Almalyk Mining and Metallurgical Combine” JSC was determined based on laboratory analysis. Depending on the composition, tungsten-cobalt-containing waste is separated in several ways, including by dissolving it in nitric acid, sulfuric acid, and sodium nitrate salts.

A muffle furnace, shown in Figure 1, is required to convert man-made waste into a solution state.

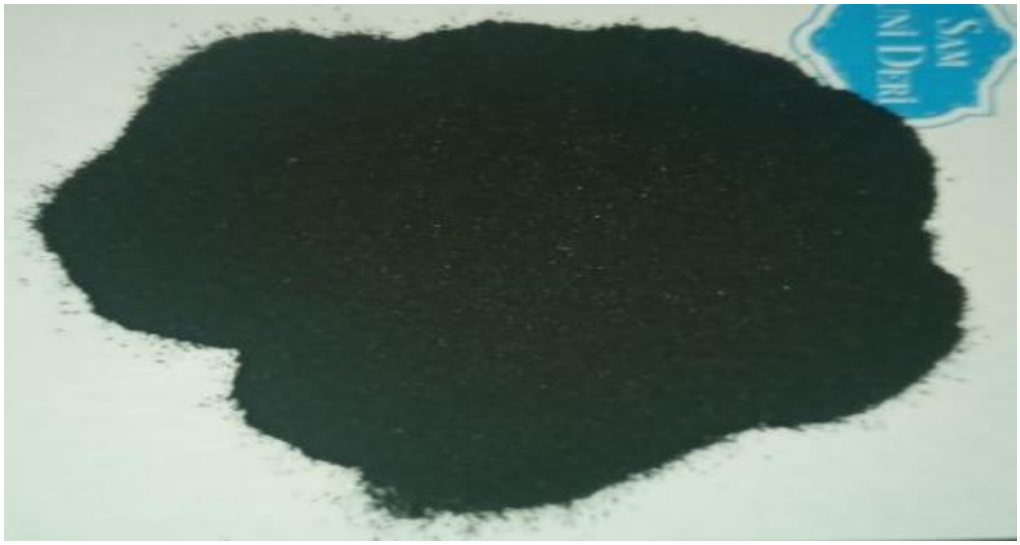
A three-zone high-temperature furnace MTF-120-3, shown in Figure 2, was used to recover the separated cobalt oxide with hydrogen.

Tungsten industrial waste containing cobalt is mixed with sodium nitrate salt, put into a ligered steel container and put into an electric furnace at a temperature of 800-900 ℃ for melting. Industrial waste begins to dissolve after 15-20 minutes. The dissolved waste liquid is poured into a stainless steel container every 15 minutes. The liquid is poured by mixing in a small amount of

water. The process is continued until the cobalt-containing tungsten industrial waste is completely liquefied. Industrial waste is completely transferred to the solution. The solution is cooled. The resulting solution is filtered. And the precipitated cobalt oxide is separated. Dried cobalt oxide powder (Figure 3) is burned and sieved.

Picture 1. A muffle furnace

Picture 2. Three-zone high-temperature furnace MTF-120-3



Picture 3. Cobalt oxide powder 70,72% (Co_3O_4)

Separated cobalt oxide powder is reduced with hydrogen in a three-zone high-temperature furnace MTF-120-3. As a result, metallic cobalt in the form of powder is obtained. Cobalt powder obtained by reduction with hydrogen is passed through a sieve with a size of 0,1-0,6 mm.

The chemistry of the process is carried out in the following sequence:

1. $WC_{(industrial\ waste)} + NaNO_3 \rightarrow Na_2WO_4 + Co_3O_4\downarrow + CO_2\uparrow$.

In the experiment, the ratio of $NaNO_3$: WC was 2:1, at a temperature of 800-900 ℃.
Industrial waste is washed in sodium nitrate solution until completely dissolved. Cobalt oxide is precipitated from the solution. Tungsten trioxide remains in the filtrate. The tungsten solution was filtered. Cobalt oxide in the form of a precipitate was isolated.

2. Cobalt oxide powder is restored to its metallic appearance by returning Co_3O_4 with hydrogen in a three-zone high-temperature furnace MTF-120-3.

The recovery process takes place according to the following reaction:

$$Co_3O_4+4H_2\rightarrow 3Co+4H_2O$$

Research results and their analysis.

In the process of extracting cobalt metal from waste according to this method, mainly pyrometallurgical processes are important. At the end of the process, cobalt metal is extracted in powder form. This is the main raw material in the production of hard alloys by the powder method. This leads to a decrease in the cost of products, increasing economic efficiency in all respects.

Conclusion.

The advantages of the proposed technology are as follows: simplicity of the technological scheme, high level of extraction of cobalt from man-made waste, low consumption of reagents, short time interval from raw materials to finished product, efficient use of man-made waste, obtaining import substitute product.

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