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Opinion

Fluoroammonium Method for Processing Scheelite Concentrate

Dyachenko AN*

MIREA - Russian Technological University, Russia

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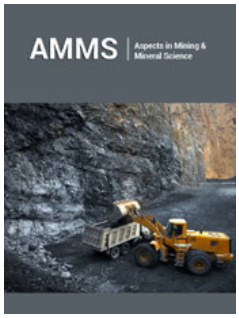

***Corresponding author:** Alexander Dyachenko, MIREA - Russian Technological University, Russia

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Opinion

The mineral resource base of tungsten is mainly represented by minerals of the wolframite and scheelite groups, which are of industrial importance [1]. Classical methods of processing scheelite concentrates are based on sintering with soda and subsequent separation of tungsten chemical concentrate on ion-exchange resins [2]. We propose to investigate a new ammonium fluoride method for processing scheelite to reduce the cost of processing and increase the purity of the resulting tungsten product. Synthetic scheelite ($CaWO_4$) was used as a model mixture. The method of sintering scheelite with ammonium bifluoride (NH_4F*HF) has been proposed to separate tungsten and calcium. Sintering temperature 200 °C. Ammonium bifluoride was taken with an excess of 10% relative to stoichiometry. The sintering time of scheelite with ammonium bifluoride under laboratory conditions was 2 hours. The process is described by a chemical reaction with the formation of insoluble calcium fluoride.

$$2CaWO_4 + 7NH_4F*HF = 2CaF_2 + 2(NH_4)_3WO_2F_5 + NH_3 + 4H_2O \quad (1)$$

Calcium fluoride was separated by filtration, the tungsten-containing solution was studied by Infrared Spectroscopy (IRS) (Figure 1). Next, the tungsten-containing solution was evaporated, and the solid residue was subjected to thermal decomposition.

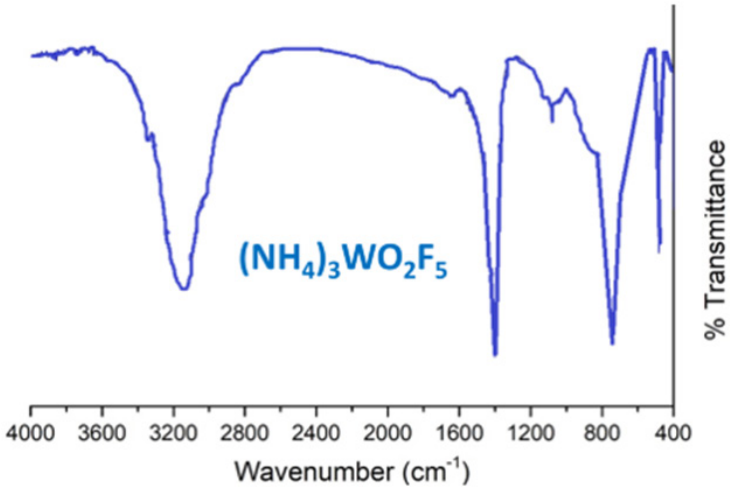

Figure 1: IR spectrum of the obtained sample of the sintering product
- wave number 3180cm^{-1} - NH_4^+
- wave number 480cm^{-1} - W-F
- wave number 790cm^{-1} - W-O.

$$(NH_4)_3WO_2F_5 + H_2O = WO_3 + 5HF + 3NH_3 \quad (2)$$

The solid stock was studied by IR spectroscopy (Figure 2). According to the results of the IR spectrum, the substance obtained as a result of the decomposition of $(NH_4)_3WO_2F_5$ is clearly tungsten trioxide (WO_3). The IR spectrum also indicates the absence of NH_4^+, O^{2-} and F^- ions. Based on the results of laboratory experiments, a schematic diagram of scheelite processing was proposed [3], (Figure 3).

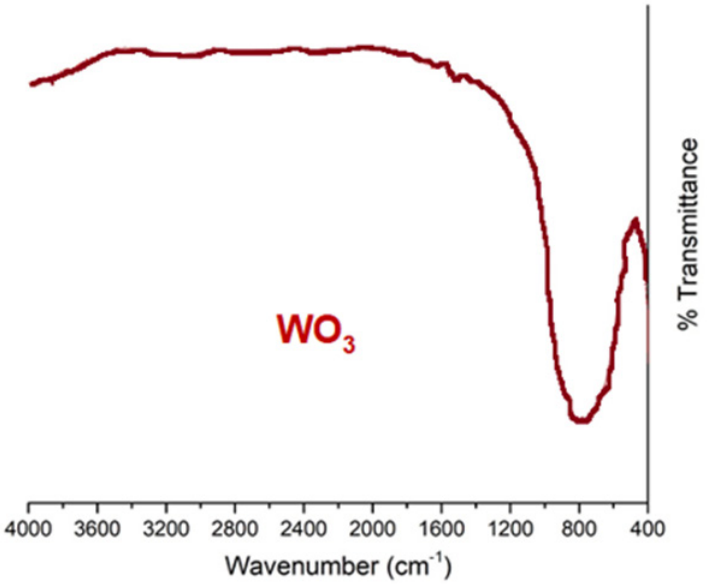

Figure 2: IR spectrum of the obtained sample of the sintering product.

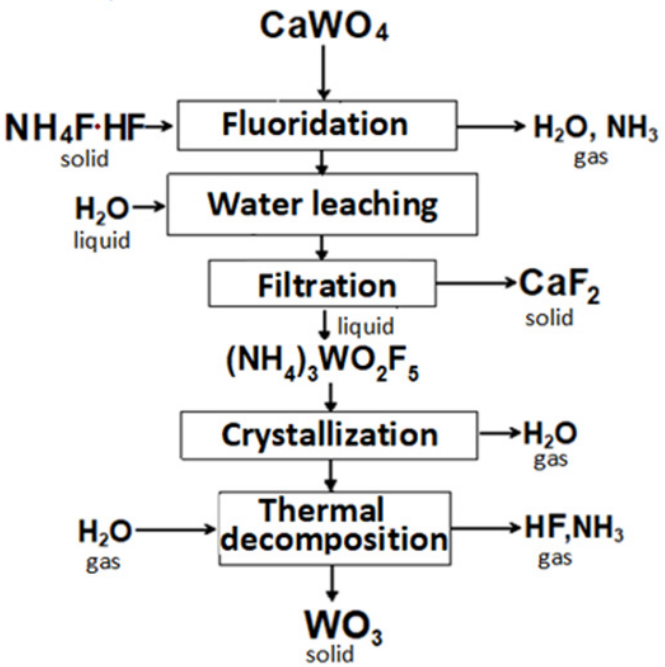

Figure 3: Fluoroammonium scheme for processing scheelite.

Result

a. It was possible to quantitatively decompose scheelite using ammonium bifluoride and separate solid CaF_2 from tungsten in the form of a $(NH_4)_3WF_9$ solution.

b. Thermal decomposition of $(NH_4)_3WF_9$ makes it possible to obtain pure WO_3.

c. The conducted experiments make it possible to start a laboratory study of natural scheelite concentrates and a

study of the possibility of purifying a tungsten product from impurities.

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