[CONTRIBUTION FROM THE JOHN HARRISON LABORATORY OF CHEMISTRY, NO. 52.]

THE SEPARATION OF TUNGSTEN TRIOXIDE FROM MOLYBDENUM TRIOXIDE.

BY MAX J. RUEGENBERG AND EDGAR F. SMITH.

Received September 7, 1900.

THE separation of tungsten from molybdenum is always of interest to those who are brought in contact with analytical methods. It has been the subject of numerous investigations and much discussion, and while comparatively good methods exist for this purpose, the analyst continues to seek for others, hoping that eventually he shall find a procedure which will be satisfactory in all respects and under nearly all conditions.

The writers have not discovered the method *par excellence*, but desire to offer briefly, in the following lines, their experience in pursuing a suggestion made in an article emanating from this laboratory; *viz.*, "tungstic acid is .... insoluble in concentrated or dilute sulphuric acid, hot or cold, whereas molybdenum trioxide is very easily and rapidly dissolved, so that we have in this deportment a very simple and exact method for the separation of the two metals."[1]

No analytical data accompanied this declaration; therefore it seemed not improper to attempt to learn the conditions most favorable for the separation. Upon trial it was found that sulphuric acid of specific gravity 1.378, dissolved molybdenum trioxide very readily and apparently did not affect the tungsten trioxide. Acid of this concentration was, therefore, used with the following mixture of the two oxides:

I. 0.7355 gram of tungsten trioxide and 0.0185 gram of molybdenum trioxide were digested for a few minutes with 25 cc. of warm sulphuric acid. The insoluble portion was filtered out and washed with water containing sulphuric acid. After drying it was ignited and weighed. It equaled 0.7350 gram.

The other trials, conducted in precisely the same manner, were as follows:

	II. Grams.	III. Grams.	IV. Grams.	V. Grams.	VI. Grams.
Tungsten trioxide taken	1.0638	0.0871	0.3588	0.8868	0.5996
Molybdenum trioxide taken	2.2712	0.6871	1.1836	1.1986	1.0770
Tungsten trioxide found ...	1.0630	0.0870	0.3587	0.8866	0.5996

[1] En. D. Desi: This Journal, 19, 242.

The filtrate containing the dissolved molybdic acid showed no tungstic acid upon examination.

These results indicate that where the two oxides are present together this mode of separation is apparently of value and merits consideration.

A weighed quantity of a ferric salt equivalent to 5 grams of ferric hydroxide was precipitated with ammonia water and the resulting precipitate, after being washed, was mixed in a beaker with different amounts of tungsten trioxide, and the resulting mixture was then digested with sulphuric acid of the strength of that used in the preceding experiments. The residual oxide was treated as before :

	I. Grams.	II. Grams.	III. Grams.	IV. Grams.	V. Grams.	VI. Grams.
Tungsten trioxide taken ..	0.5282	0.2087	1.3270	0.2004	0.9091	0.2263
Ferric hydroxide taken ...	5.0000	5.0000	5.0000	5.0000	5.0000	5.0000
Tungsten trioxide found ..	0.5278	0.2086	1.3265	0.2003	0.9088	0.2262

We may conclude from these trials that the solubility of the trioxide in the sulphuric acid is in no wise affected by the presence of the iron.

UNIVERSITY OF PENNSYLVANIA.

NEW BOOKS.

THE MINERAL INDUSTRY: ITS STATISTICS, TECHNOLOGY, AND TRADE IN THE UNITED STATES AND OTHER COUNTRIES, TO THE END OF 1899. EDITED BY RICHARD P. ROTHWELL. Vol. VIII. Large 8vo. xxviii+986 pp. With many illustrations. New York: The Scientific Publishing Co. Price, $5.00.

This new annual volume of a well-known and greatly valued series fully sustains the reputation already obtained. The difficulty in obtaining accurate information of this character is well known, and the rapid publication of a large volume like this, requiring the cooperation of so many persons, reflects the greatest credit upon all those concerned in it. The year 1899 was a great year for the mineral industry in the United States, the production in nearly all metals and minerals showing a decided increase. This is especially noticeable in Portland cement, where the increase is from 3,584,586 barrels of 400 lbs. in 1898 to 5,805,620 barrels in 1899. Among the new products listed in recent years are ferromolybdenum, 6,000 lbs. in 1899 ; molybde-