

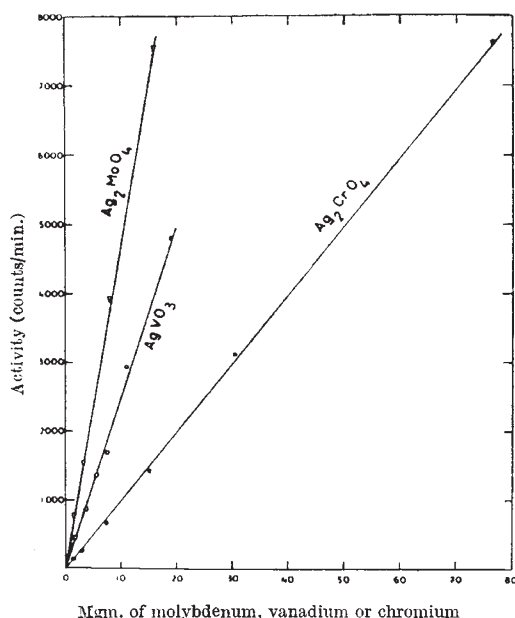
LETTERS TO THE EDITORS

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Radiochemical Determination of Chromium, Vanadium and Molybdenum by means of Radioactive Silver

THE extreme sensitivity of measurements of radioisotopes makes it possible to use the artificial radioelements as an aid in analytical chemistry. In our experiments we have used radioactive silver for making quantitative estimations of small amounts of chromium, vanadium or molybdenum present in steel or in various substances. Insoluble silver salts can be prepared by means of these elements. Previous investigations have shown that all these silver compounds are suitable for radioactive measurements, except silver vanadate, which gives no reproducible results. Therefore, we dissolve the silver metavanadate in boiling 50 per cent nitric acid, and silver is precipitated as chloride; the latter is filtered on a fritted glass filter, so giving directly a radioactive sample for counting. A Geiger-Müller tube (*R.C.L.* Chicago) with thin mica window is used for the radioactivity measurements.

Radioactive silver, ^{110}Ag (supplied by the Isotope Division, Atomic Energy Research Establishment, Harwell), is dissolved in nitric acid, and the solution is evaporated to dryness on a water-bath. A neutral solution of radioactive silver nitrate is prepared; and by means of this solution chromium is precipitated as silver chromate¹, vanadium as silver vanadate² and molybdenum as silver molybdate³. As shown in the accompanying graph, standard curves are obtained when the activities of the precipitate are plotted against the corresponding amount of metal used. From these curves, unknown concentrations of chromium, vanadium or molybdenum can easily be determined if the same experimental and geometrical conditions are reproduced.



Less than 1 mgm. of metal can be determined. However, a solution of radioactive silver nitrate with very much higher specific activity can be used, and eventually the smallest amount of metal detectable is limited by the solubility product. This radiochemical method is very quick, accurate and also convenient, because the same radioactive indicator is used for the chemical determination of different elements.

One of us (C. B.) wishes to thank Prof. G. Gueben for the opportunity of working in the Institute of Nuclear Studies, Liège.

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- ¹ Gooch, F. A., and Weed, L. H., *Z. Anorg. Chem.*, **59**, 94 (1908).
² Carriere, E., and Guiter, H., *C.R. Acad. Sci., Paris*, **204**, 1339 (1937).
³ McCay, LeRoy W., *J. Amer. Chem. Soc.*, **56**, 2548 (1934).

Structures of Uranium

Dickins, Douglas and Taylor¹ have recently pointed out that the tetragonal structure for β -uranium, proposed by Tucker² on the basis of the room-temperature X-ray examination of a quenched uranium-chromium alloy containing 1.4 atomic per cent chromium, is essentially the same as that of the σ -phase, which is of such great technical importance. Kasper, Decker and Belanger³ have obtained similar results.

We have been engaged for some time in the X-ray examination of uranium at high temperatures and have succeeded in obtaining satisfactory powder photographs of β - and γ -uranium, using filings sealed off in an evacuated silica capillary tube. Attempts made to index the β -photographs by the method described by Ito⁴ had led to a monoclinic unit cell containing 30 atoms and having the dimensions $a = 9.99 \text{ \AA}$, $b = 7.85 \text{ \AA}$, $c = 8.67 \text{ \AA}$ and $\beta = 101^\circ 42'$; but comparison of these photographs with those of a 1.4 atomic per cent chromium-uranium alloy quenched from 720°C . showed that there was a very strong resemblance, although obviously the unit-cell dimensions of the two substances differed considerably.

Detailed analysis showed that all the lines of the β -uranium photograph could be explained with a tetragonal unit cell containing 30 atoms and having the dimensions shown in the accompanying table, with the exception of two very faint lines. Several small-angle reflexions, occurring only as spots on photographs of stationary specimens, were also explained more satisfactorily by the monoclinic than by the tetragonal unit cell; but there was no unequivocal evidence that the tetragonal structure is not essentially correct. However, there are marked discrepancies between the calculated and observed intensities which show, as Tucker himself says, that much more work is necessary before the final structure of the uranium-chromium alloy can be elucidated. More significant, perhaps, are the intensity differences observed between β -uranium and the uranium-chromium alloy, which show that the two structures, although based on the same theme, are not identical, and make it clear that the detailed structure of β -uranium will have to be worked out from X-ray observations on the element itself and not on the chromium alloy. (Note added in proof. X-ray photographs of the uranium-chromium alloy taken at 720°C . have confirmed these intensity differences.)