Title

CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XI. PREPARATION AND ISOLATION OF Os185 AND Re183,184 FROM TUNGSTEN

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XI. PREPARATION AND ISOLATION OF Os^{185} AND $Re^{183,184}$ FROM TUNGSTEN

Jeanne D. Gile, Warren M. Garrison and Joseph G. Hamilton

May 26, 1950

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CARRIER-FREE RADIOISOTOPES FROM CYCLOTRON TARGETS XI. PREPARATION AND ISOLATION OF Os^{185} AND $Re^{183,184}$ FROM TUNGSTEN*

Jeanne D. Gile, Warren M. Garrison and Joseph G. Hamilton

May 26, 1950

Crocker Laboratory, Radiation Laboratory, and Divisions of Medical Physics, Experimental Medicine and Radiology; University of California, Berkeley and San Francisco, California.

Long-lived radioisotopes[1] of rhenium and osmium have been isolated in the carrier-free state from a tungsten exit strip which was removed from the 60-inch cyclotron at Crocker Laboratory after a period of four months of almost continuous operation with protons (10 Mev), deuterons (20 Mev) and alpha particles (40 Mev). The possible transmutation reactions include: W(d,xn)Re, W(p,xn)Re, W(α,pxn)Re, and W(α,xn)Os. In the procedure reported here, the long-lived isotopes of rhenium, $Re^{183,184}$, and osmium, Os^{185}, produced by the nuclear reactions $W^{182}(d,n)Re^{183}$, $W^{183}(d,2n)Re^{183}$, $W^{183}(d,n)Re^{184}$, $W^{184}(d,2n)Re^{184}$, $W^{182}(\alpha,pn)Re^{184}$, $W^{182}(\alpha,n)Os^{185}$ and $W^{183}(\alpha,2n)Os^{185}$, were separated from the target element and from other possible long-lived transmutation products by a combination of volatility and solvent extraction methods.

The tungsten strip (approx. 2 gm.) was fused with 10 gm. of KOH and 0.5 gm of KNO_3 at 500°C for 30 minutes to form the water-soluble tungstate, perrhenate and osmate. The fused mass was dissolved in a minimum volume of cold water and centrifuged to remove insoluble matter. The solution was acidified with 16 N HNO_3 precipitating tungstic acid which was removed by centrifugation. The supernatant containing the carrier-free radio-rhenium and radio-osmium was diluted to 5 N and transferred to an all-glass distilling flask. The carrier-free radio-osmium,

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[1] G. T. Seaborg and I. Perlman, Rev. Mod. Phys. 20 585 (1948)

presumably as the volatile OsO_4, was distilled into an ice-cooled trap containing 5 N HNO_3. The rhenium activity remained in the residual solution. The HNO_3 distillate (25 ml) was extracted with two 25 ml aliquots of CCl_4 which removed over 95 percent of the radio-osmium from the aqueous phase. After washing with water to remove HNO_3, the radio-osmium was quantitatively re-extracted from the CCl_4 phase with 2 ml of 0.1 N NaOH which on neutralization gave an isotonic saline solution for biological investigation. The carrier-free radio-rhenium was isolated from the residual HNO_3 solution using the distillation procedure previously[2] described in the preparation of carrier-free rhenium from tantalum. The Os^{185} was identified by the 97-day half-life and by the 0.75 Mev gamma ray previously reported[3,4]. The $Re^{183,184}$ showed the 0.2 and 0.7 Mev beta particle and the 1.0 Mev gamma ray reported[5] for 50-day Re^{184}. Half-life measurements showed an approximately 57-day period which began to lengthen after 3 weeks due to the approximately 240-day Re^{183} isotope. The activities were further identified by chemical separation using W, Re and Os carriers.

We wish to thank Professor G. T. Seaborg for helpful suggestions, Mr. T. Putnam and Mr. B. Rossi and the crew of the 60-inch cyclotron for bombardments and Mrs. Alberta Mozley for assistance in counting.

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[2] J. D. Gile, W. M. Garrison, J. G. Hamilton, J. Chem. Phys. 1950

[3] L. I. Katzin and M. Pobereskin, Phys. Rev. 74, 264 (1948)

[4] L. J. Goodman and M. L. Pool, Phys. Rev. 71, 288 (1947)

[5] G. Wilkinson and H. G. Hicks, Phys. Rev. 77, 314 (1950)