

Recovery of ^{244}Pu from irradiated targets for production of element 114*

J. Runke^{1,#}, K. Eberhardt¹, J. V. Kratz¹, Ch. E. Düllmann² and M. Schädel²

¹Institut für Kernchemie, Johannes Gutenberg-Universität Mainz, Germany; ²GSI, Darmstadt, Germany

The ^{244}Pu targets [1] (PuO_2 electrodeposited on Ti backing) were irradiated during recent bombardments with $^{48}\text{Ca}^{10+}$ ions to produce $^{288,289}\text{114}$ [2,3]. During these bombardments with up to 3.6×10^{18} ions, targets and backings underwent changes that made reprocessing and production of new targets for forthcoming experiments desirable.



Figure 1: Teflon vessel.

Recovery of ^{244}Pu from one arc-shaped segment was accomplished as follows: The Al-target frame was inserted into a Teflon vessel containing a cavity into which the frame could be inserted, see Figure 1. With a sharp knife, the target was cut out of the frame, the frame was removed, and the target together with the Ti backing was dissolved in hot conc. HCl. The dissolution of the Ti backing was incomplete. The central part of the backing that had received the highest beam intensity did not dissolve. The resulting solution with the remainder of the undissolved Ti was evaporated to near dryness, transferred into a 10 ml measuring flask and filled with 8 M HCl. An aliquot of that solution was removed, evaporated to dryness, and the α -particle activity was determined. The total activity was used for yield determination. The results indicate that more than 80 % of the Pu had been recovered.

*Sponsored in the frame of a GSI R&D project (MZJVKR).

#runke@uni-mainz.de

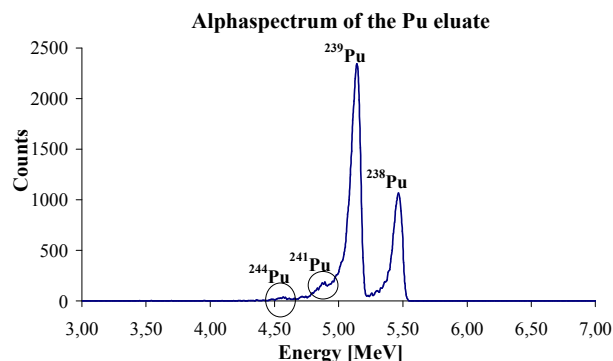


Figure 2: Alpha spectrum of the Pu eluate.

The Pu/Ti solution in 8 M HCl was transferred to a AG 1x8 anion-exchange column (3 x 50 mm), and was washed subsequently with 10 x 1 ml of 8 M HCl to remove the Ti and the ^{241}Am from the column. Then, the Pu was eluted from the column in 8 x 1 ml of 0.5 M HCl. Figure 2 shows the spectrum of α particles of an aliquot of the eluate. Due to the isotopic composition of the plutonium (97.9 % ^{244}Pu , 1.3 % ^{242}Pu , 0.7 % ^{240}Pu , < 0.1% other), the main α activities are associated with ^{238}Pu and ^{239}Pu . 100 μl of that solution was removed, filled up to 2 ml and was irradiated with thermal neutrons in the TRIGA reactor at the Institute of Nuclear Chemistry at the University of Mainz at 100 kW together with a second reference sample containing 9.62 μg ^{244}Pu for 6 h. After a decay time of 18 h, both samples were assayed for the 327.6 keV γ -activity of ^{245}Pu at a Ge detector, see Figure 3. The activation analysis showed a ^{244}Pu recovery of 89 %.

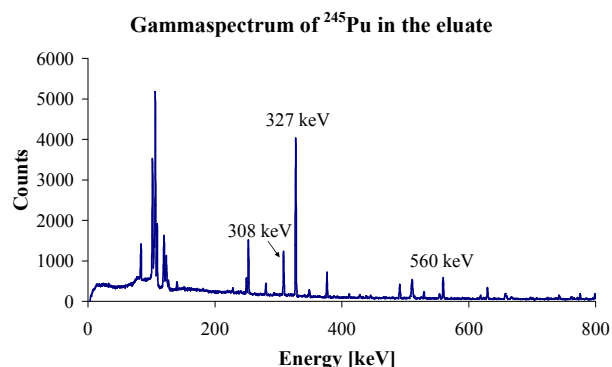


Figure 3: Gamma spectrum of ^{245}Pu solution.

References

- [1] K. Eberhardt *et al.*, contribution to this report.
- [2] Ch. E. Düllmann *et al.*, contribution to this report.
- [3] A. Yakushev *et al.*, contribution to this report.