Technological Laboratory of the LMU

H. J. Maier, R. Großmann, H. U. Friebel, and D. Frischke

1. ^{244}Pu Targets

^{244}Pu is produced by sequential neutron capture on ^{238}U and subsequent electromagnetic separation of the accumulated Pu isotopes. Since ^{244}Pu is the last link in a chain of 6 captures, its production rate is extremely low, leading to a most limited abundance of the isotope. As a consequence, only a small quantity of 1 mg of ^{244}Pu was available for the production of a series of targets to be used to measure the isotopic shift on ^{244}Pu. Using a fraction of 540 μg of the isotopic material, a number of eight $^{244}PuO_2$ targets in the thickness range of 10–60 μg cm^{-2} were prepared on thin carbon backings of 35 μg cm^{-2}. This was performed taking advantage of a hot crucible microevaporator of high material collection efficiency, which is heated by low-tension electron bombardment [1].

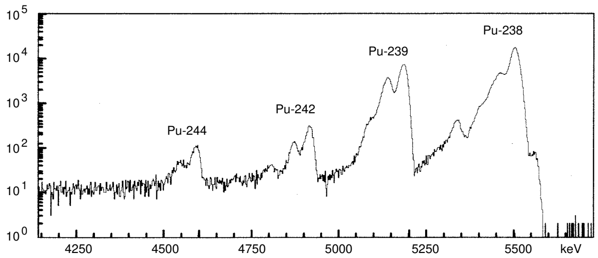

Fig. 1: α-spectrum of a 97.9% enriched ^{244}Pu target of 50 μg cm^{-2} thickness. The isotope ^{238}Pu, which is present in the sample at a level of 0.005% only, produces the most prominent peak in the spectrum.

^{244}Pu has a half-life of 8.0 10^7 years. Hence, although the ^{244}Pu isotopic material is enriched to 97.9%, the α-spectrum of an individual target is dominated by the short-lived isotopes ^{238}Pu, ^{239}Pu, and ^{242}Pu, as shown in fig. 1. This implies, for instance, that a target with an expected ^{244}Pu activity of 10 Bq has a total activity of 3250 Bq, requiring adequate safety precautions during handling.

2. ^{230}Th Targets

A batch of ^{230}Th targets on thin carbon backings of 20 μg cm^{-2} was prepared for a ^{230}Th(d,pf) experiment at the Munich tandem accelerator. For this purpose, approximately 20 mg of 99.98% enriched $^{230}ThO_2$ were available from ORNL. Since spectroscopy of fission fragments requires targets of extremely smooth microstructure, cold crucible electron beam evaporation was chosen as a production method [2] despite of its comparatively low collection efficiency of about 1 μg cm^{-2} per mg of source material. A total of 16 targets of thickness 10–30 μg cm^{-2} resulted from this production run. A Leybold ESV 6 type electron gun with a small hearth of 0.6 cm^3 volume was used. It is part of a permanent setup for standard thin film deposition in a box coater, which is installed in one of the gloveboxes of the hot-lab facility. A photograph of this setup is shown in fig. 2.

References

[1] H. J. Maier *et al.*, Jahresbericht 1998, p. 80
[2] H. J. Maier *et al.*, Nucl. Instr. Meth. **B56/57** (1991) 926

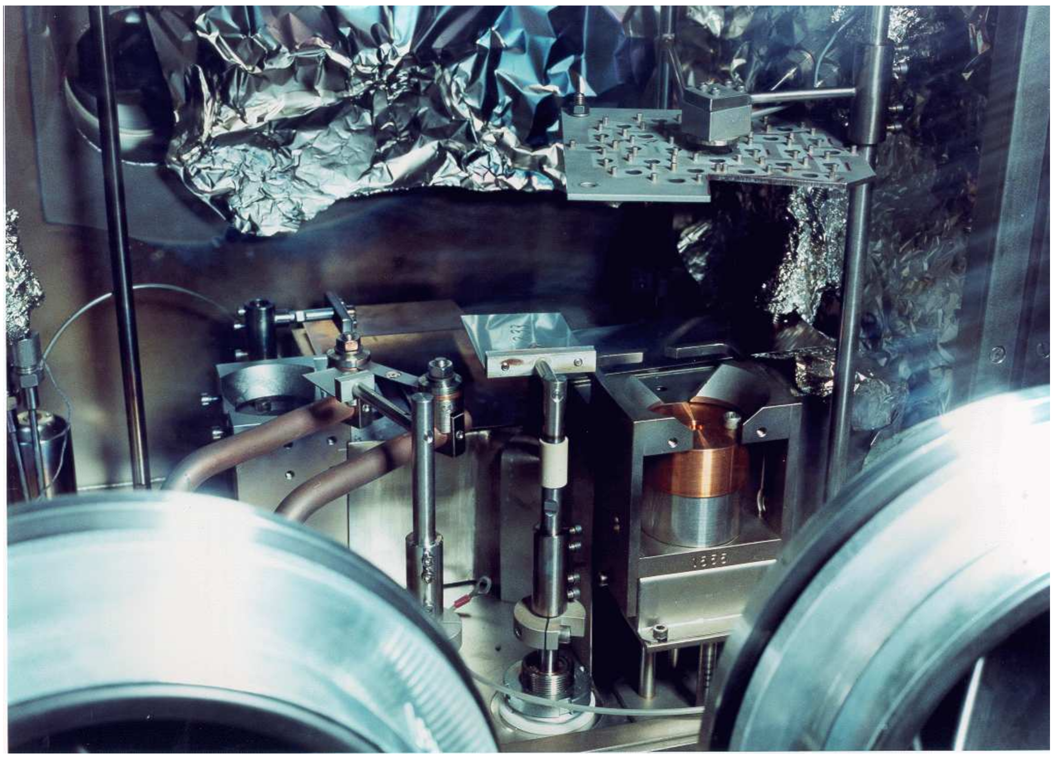

Fig. 2: Inside view of the evaporation chamber, featuring at the right the electron gun used for $^{230}ThO_2$ evaporation with its related shutter, the substrate holder, and the quartz crystal sensor head. In the foreground, parts of the glove connection rings in the front plate of the glovebox are seen.