Further investigations on target preparation for heavy element studies.

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For heavy element studies at GSI, again lanthanide and actinide target segments for the rotating wheel assembly were prepared by molecular plating. ^{232}Th targets were used during two ^{12}C beamtimes to investigate the decay of ^{239}Cm [1]. Er has been again by ^{12}C to perform Multi-Column Experiments with Tungsten. The procedures for molecular plating have been applied basically as approved before [2]. Ti with a thickness of 5µm has been used as backing for both, Th and Er. Additionally, one target wheel with three segments of Th on an 15µm Be-Backing had to be prepared as well since the Th on the Ti-backing was lost almost completely from the rotating wheel during the first beamtime in september 2004. See Table 1.

Table 1: Segments for rotating wheel at GSI

Isotope	***Backing***	***Thickn. [µg/cm²]***
Th	Ti / 5µm	700
Th	Ti / 5µm	710
Th	Ti / 5µm	410
Er	Ti / 5µm	550
Er	Ti / 5µm	570
Er	Ti / 5µm	560
Th	Be / 15µm	1000*
Th	Be / 15µm	900
Th	Be / 15µm	950*

* plated twice

In order to improve the yield and the surface quality of all of those targets numerous tests have been done prior to and after the actual GSI -targets. The use of an ultrasonic probe for cleaning the backing foil prior to deposition seemed to be promising. The optimized parameters are listed below:

Pretreatment:

- washing the already mounted backing with acetone, HCl , H_2O, isopropanol.
- ultrasonic cleaning in isopropanol
- 14 ml fresh and water free isopropanol

Electrodeposition of Th

- 1.0-1.5 ml Th in isopropanol (corresponding to 2mg/ml)
- 10µl 0,1n HNO_3
- Voltage 10 min at 0.5 kV, 50min at 1.0kV

Electrodeposition of Er

- 3-5µl Er in 0.1n HNO_3 (corresponding to 200mg/ml)
- Voltage 1.0 kV constantly for 60min

Depositions yields are calculated from neutron activated aliquots of the plating solution prior to and after the procedure.
With ultrasonic treatment, which lasted up to 120min, the foil surfaces looked more structured than without this pretreatment. However, so far, there is no linear dependence of surface stability and deposition yield on the duration of the ultrasonic pretreatment of the Ti or Be backings.
A second issue was to achieve the required target thickness, surface stability and uniformity by two or three subsequent plating procedures. The quantity of Th used for each plating was decreased from 1.5ml to 0.5ml isopropanolic Th-Solution because higher deposition yields at lower concentration seem to be achieved. All other conditions remained as before. In general, the surfaces of all so prepared targets seemed to be more uniform and stable than for targets prepared at once. The densities of multi-plated targets varied between 814–1170 µg/cm² what corresponds to a deposition yield of 55–78 %. See table 2.

Table 2: Multi plated targets

Target	1	2	3	4
1.pl.[µg/cm²]	329	131	285	212
2.pl.[µg/cm²]	377	233	430	264
3.pl.[µg/cm²]	310	474	455	338
sum [µg/cm²]	**1016**	**707**	**885**	**602**

Backing: Ti 25µm, other conditions see text.

Besides the target preparation recent work focuses also on requirements of the newly formed TASCA project. Some basic investigations are already in progress since december 2004. Especially the usability of very thin aluminium (2-10µm) as backing material for uranium deposition takes priority.

References:

[1] Z. Quin et al., " Search for the 'missing' α-decay branch in ^{239}Cm", GSI Scientific Report 2005

[2] K.Eberhardt et al., "Preparation of Targets by electrodeposition for heavy element studies", Nuclear Instruments and Methods in Physics Research A 521 (2004), 208-213