Target Development for TASCA

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The main components of the **T**rans**A**ctinide **S**eparator and **C**hemistry **A**pparatus **TASCA** are already installed and the separator is now in the commissioning phase. A first beam time took place in April 2006 and further commissioning experiments were performed in May and November 2006. An overview of the current status is given in separate contributions [1-3].

In previous target tests, thin C- and Ti-foils proved to be more stable when irradiated with intense ^{12}C- and ^{26}Mg-beams compared to Al as a backing material. For the beam time in May a number of different targets materials have been applied, among them a set of ^{nat}Gd-targets produced by Molecular Plating at UMZ on a 5 µm Ti-backing foil. These targets have been irradiated with a 1.43 µA$_{part}$ Cr^{7+}-beam. The targets withstood the irradiation without damage although the use of a relatively thick Ti-backing resulted in an increased background signal in the focal plane detectors. One main goal of the experiment in November was the test of different ^{238}U-targets with an intense ^{40}Ar-beam. Two target wheels have been irradiated – TN4 and TN8 – both consisting of three different kinds of targets. Table 1 comprises the target specifications. The number on the left indicate a particular segment.

Table 1: ^{238}U test-targets for TASCA

Target wheel TN4			
No.	**Backing**	**Target**	**Cover**
1	C, 40 µg/cm^2	539 µg/cm^2	C, 10 µg/cm^2
2	Ti, 1.9 µm	521 µg/cm^2	C, 10 µg/cm^2
3	Ti, 1.9 µm	532 µg/cm^2	not covered

Target wheel TN8			
No.	**Backing**	**Target**	**Cover**
1	C, 37 µg/cm^2	539 µg/cm^2	C, 10 µg/cm^2
2	Ti, 2.2 µm	511 µg/cm^2	C, 10 µg/cm^2
3	Ti, 2.2 µm	491 µg/cm^2	not covered

All targets have been delivered by the GSI target laboratory. Here, the U-layer has been produced by sputtering of depleted uranium in its metallic form with a ^{235}U content less than 0.2%. In some cases the target material has been covered with a thin C layer in order to prevent losses of the target material during irradiation with the $^{40}Ar^{7+}$-beam of successively increasing intensity. After a certain beam integral was applied, the targets have been inspected to check for damage. Target wheel TN4 has first been irradiated for a total of 52'29" with increasing beam intensity up to 2 µA$_{part}$. The target segments showed severe damage with holes and cracks. TN4 was then replaced by TN8 which was irradiated for 1h27'38" with increasing beam intensities up to 1 µA$_{part}$. Figures 1 shows TN8 before and after irradiation, respectively. After irradiation segment 1 (C-backing) showed a visible whole, whereas segments 2 and 3 (Ti-backing) remained mechanically stable but show intense colour changes in the central part (see fig.1).

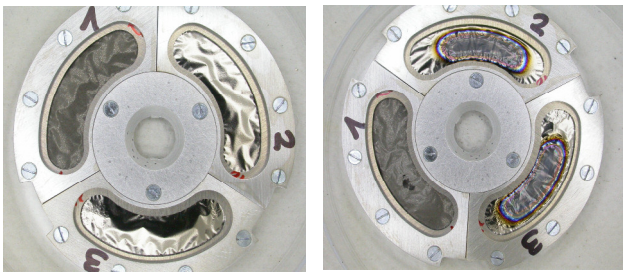

Figure 1: Target TN8 before (left) and after irradiation (right) with a ^{40}Ar-beam of 1 µA$_{part}$ maximum intensity.

Currently, the targets are further inspected by α-particle counting of the U-layer in order to check for material losses. Furthermore, the targets will be inspected by electron beam diagnostics and – if the activation products have decayed – by autoradiographic imaging [4] to check for losses and target homogeneity.

At UMZ work is currently under way to find optimum conditions for the deposition of ^{244}Pu (up to 500 µg/cm^2) on 2 µm thin Ti backing foils by Molecular Plating from isobutanolic solution. ^{244}Pu is of special interest as a target material for chemical investigations of the heaviest elements, since relatively long lived isotopes of Rf to Hs - with half-lives in the order of a few seconds - can be produced in the bombardment of a ^{244}Pu-target with beams ranging from ^{22}Ne up to ^{30}Si. ^{244}Pu is also the optimum target for production of Z=114 with a ^{48}Ca beam.

References

[1] M. Schädel et al., contributions to this report
[2] Ch. E. Düllmann et al., contributions to this report
[3] A. Yakushev et al., contribution to this report
[4] D. Liebe et al., contribution to this report

See also http://www.gsi.de/TASCA