TASCA Target Group Status Report

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The **T**rans-**A**ctinide **S**eparator and **C**hemistry **A**pparatus **TASCA** is currently installed at cave X8 and is dedicated to investigate the chemical and physical properties of the heaviest elements. An overview of the current status is given in a separate report [1].

For the production of Rf and Db isotopes, cold fusion reactions can be applied using Ti-beams with Pb- or Bi targets, respectively. Low melting metals can be substituted by compounds for application in high intensity beams [2]. However, to produce longer-lived isotopes of neutron-rich heavier actinides and transactinides hot fusion reactions with actinide targets are required. Here, possible target materials range from Th up to Cm or heavier elements.

We combined the different methods and capabilities of the four target laboratories involved to solve the challenging task of developing appropriate backings and targets. For first tests, we kept the geometry of the existing target wheel of the nuclear chemistry experiments at GSI unchanged. As we plan to install thinner backings for TASCA – so far 15 to 20 µm thick Be foils were used - it is necessary to fix the backing on an adequate frame, as can be seen in Figure 1.

Al backings and Ti backings, supplied from different companies with different qualities, were produced by cold rolling. C backings were produced by resistance heating and applied without annealing. After two test beam times with ^{12}C beam (500 pnA) and ^{40}Ar beam (800 pnA), we now focus on 3 µm Ti or 35 µg/cm² annealed C, alternatively, which will be tested with thermally evaporated UF_4, a target material in the near future.

As the target laboratory at GSI is specialised in evaporation, sputtering, and rolling of stable elements up to natural uranium, the foils discussed above were prepared there. The other three laboratories have the expertise of handling highly radioactive materials including the chemical purification of target material and the recovery of rare target material from used targets. After the decision for the appropriate backing has been made, backing foils will be given to the target laboratory at the LMU, where radioactive targets (Ra, Ac, Th, U, Pu, Cm) can be prepared by microevaporation. The group at the TUM offers the analytical capabilities to measure concentrations of actinide elements in solution (also Pu, Cm). For the nuclear chemistry experiments at GSI the radioactive actinide targets are prepared by electrochemical deposition at UMZ.

The search for optimal conditions for the electrochemical deposition of U (as uranylnitrate) from organic solution by molecular plating on thin Al- and Ti-backing foils is currently going on at LBNL and UMZ [3]. Figure 1 shows a picture of a 265 µg/cm^2 ^{238}U-layer produced by molecular plating on a 25 µm thick Al-backing [3]. Target performance - when exposed to an ion beam - has not been tested yet. At UMZ a new electrochemical cell for improved deposition yield and uniformity of the target layer is under construction based on the design and the experience obtained at RIKEN [4]. Furthermore, optical microscopy, electron microscopy, and energy dispersive x-ray analysis are used for monitoring target thickness, chemical purity and homogeneity of the target surface. UMZ is testing a commercially available autoradiographic imager (Packard Instant Imager).

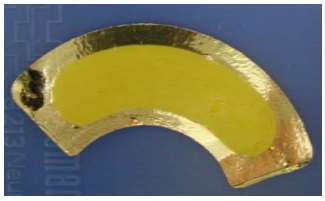

Figure 1: ^{238}U-target (265 µg/cm^2) produced by molecular plating of uranylnitrate from isobutanolic solution.

A new target station for TASCA is currently developed at GSI. This device is designed so that it can be used with the existing rotating actinide target wheel from GSI and with the new rotating target wheel system that is presently under development at LBNL for the Berkeley Gas-filled Separator (BGS), as well.

All contributions to the TASCA Working Group meetings and Workshops are accessible via www-w2k.gsi.de/tasca.

References

[1] M. Schädel et al., this report
[2] B. Kindler et al., accepted for NIM A
[3] D. Liebe et al., this report
[4] H. Haba, TASCA 05, Oslo, 2005; http://www-w2k.gsi.de/tasca05/images/contributions/TASCA05_Haba.pdf