

## Reduction of Mo(VI) in ALOHA

B. Wlodzimirska<sup>1\*</sup>, K. Eberhardt<sup>1</sup>, J.V. Kratz<sup>1</sup>, S. Zauner<sup>1</sup>, W. Brüchle<sup>2</sup>, E. Jäger<sup>2</sup>, M. Schädel<sup>2</sup>, E. Schimpf<sup>2</sup>  
<sup>1</sup>Institut für Kernchemie, Universität Mainz, <sup>2</sup>Gesellschaft für Schwerionenforschung, Darmstadt

In previous studies, tungsten (W) and molybdenum (Mo), the homologs of seaborgium (Sg), were used to develop a reduction experiment in which, for the first time, a transactinide element is attempted to be reduced to a lower oxidation state [1,2]. It had been shown theoretically, that reduction of Sg(VI) to Sg(III) should be feasible with a strongly reducing metal such as Al [3]. Accordingly, Strub et al. [1,2] studied reduction of W and Mo in 0.1 M HCl/0.1 M HF in a heterogeneous system with Al metal at a solution temperature of 80° C. Even though it could be shown that reduction of W and Mo was possible in principle, the distinction of M(III) from M(VI) on an anion-exchange column (1.6 x 8 mm) was unsatisfactory. (M(III) is supposed to be eluted immediately from the anion-exchange column while M(VI) is expected to be sorbed on the resin. Unfortunately, with the small-size columns of the ARCA type, a sufficient retention of M(VI) on the anion-exchange column was never achieved [1,2].

As an alternative to the discontinuous ion-exchange chromatography with ARCA, Kronenberg et al. [4] developed an on-line chromatography with the multi-column technique combined with the quasi-continuously working gas-jet collection system ALOHA. We have installed this system at the TRIGA reactor, see Fig. 1. A <sup>235</sup>U target covered with 15 µm Al to suppress the heavy-mass fission products was irradiated with neutrons and the light-mass fission products were stopped in He gas containing KCl aerosols. At a flow rate of 2 L/min, the activity bearing aerosols were transported from the target chamber through a 1.5 mm i.d. capillary to ALOHA where the aerosol was deposited on a Ta disc by impaction. The deposited KCl was dissolved in mixed HCl/HF solutions of different molarities and the solution was pumped at 1 mL/min through three columns. The first one served as filter column F [4] and was

filled with 67 mg of the cation-exchange resin AG 50Wx8. The second one contained in a narrow bore an Al wire of 58 mm length heated to 80° C.

The third one was identical with column F. Mo(VI) passing the column F as anionic fluoride complex, was reduced in contact with the Al, and the reduced species was sorbed in the third column. Variation of the molarity of the mixed HCl/HF solutions showed that optimum yields were obtained with 0.001 M HCl/0.01 M HF. Yields of dissolution in ALOHA including the yield of impaction were about 90 %. The yield of reduction and the retention of the reduced Mo on the third column was nearly quantitative. The amount of Al dissolved per mL of 0.001 M HCl/0.01 M HF was 0.061 mg. On the cation-exchange columns used for the recovery of <sup>253</sup>Es, the long-lived descendant of <sup>265</sup>Sg, the dissolved Al does not present a problem as it is eluted as fluoride complex, i.e., the capacity of the cation-exchange columns is not limited by the dissolved Al.

In summary, the problems encountered in previous versions of the reduction experiment in group 6 have been solved so that the experiment with Sg can be envisaged.

### References

- [1] E. Strub et al., Jahresbericht 1999, IKMz 2000-1, A11
- [2] E. Strub, Doctoral dissertation, Mainz (2000)
- [3] V. Pershina et al., J. Phys. Chem. A **103**, 8463 (1999)
- [4] A. Kronenberg et al., Jahresbericht 2001, IKMz 2002-1, A4

\*on leave from Institute of Nuclear Chemistry and Technology, Warsaw, with a fellowship of IAEA

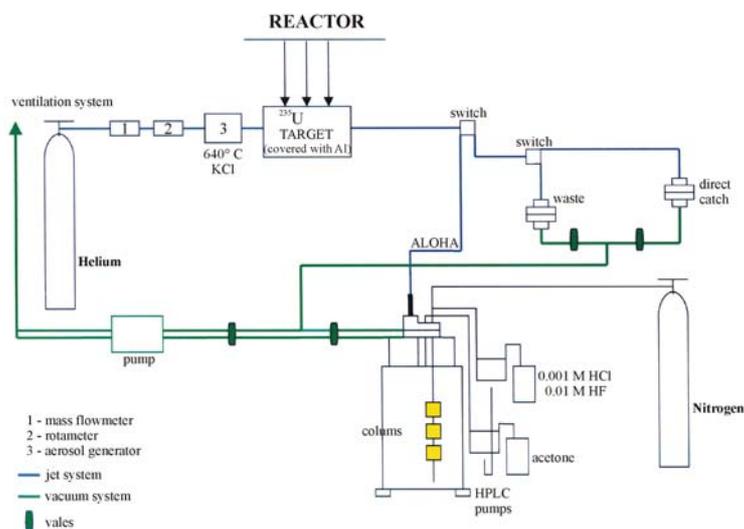


Fig. 1: Schematic of the equipment