DEPOSITION AND DETECTION OF VOLATILE OXIDES ON METALLIC SURFACES WITH CALLISTO

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So far, no chemical properties of element 108, Hassium, are known. It can be assumed, that Hs has similar properties like the homologous elements ruthenium and osmium, i.e., that Hs forms a volatile tetroxide.

To form volatile oxides in-situ, nuclear reaction products are slowed down in oxygen containing gas mixtures, which transport these products. They are deposited and detected with **CALLISTO** (***C***ontinuously Working ***A***rrangement For C***l***uster***l***ess Transport Of ***I***n-si***t***u Produced Volatile ***O***xides) [1].

For the detection of α-active nuclides, a detector phalanx, as shown in Fig. 1, was developed. On one side, ten (10x10) mm^2 PIN diodes are linearly arranged. On the opposite side, a stripe of metallic Na was placed at a small distance. The carrier gas flows above the Na surface, where volatile oxides deposit and their α-decay can be detected.

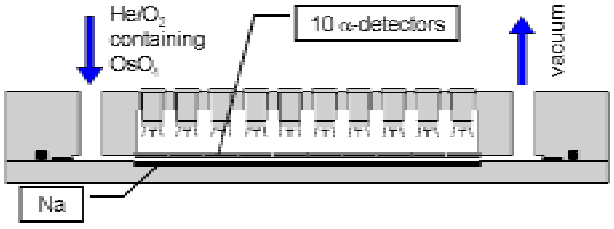

Fig. 1

The deposition efficiency of the volatile oxides depends on various factors, e.g., the deposition of OsO_4 on Na decreases considerably with increasing gas flow and it increases with decreasing humidity of the gases, see Fig. 2.

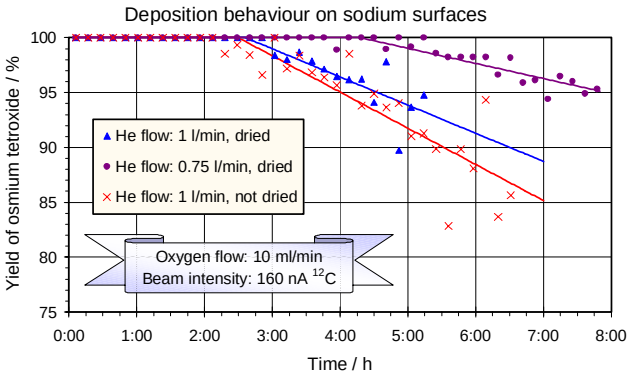

Fig. 2

^{172,173}Os, formed in a ^{26}Mg + ^{152}Gd test-reaction, are unambiguously identified in the α-spectrum, see Fig. 3. Additional smaller peaks can be assigned to other Os-isotopes.

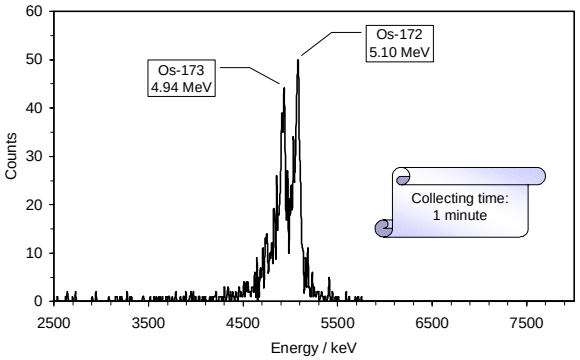

Fig. 3

In a test experiment, a good Po separation was achieved. After 50 min measuring time, no polonium, formed with a U-target, could be detected in the α-spectrum. With a He/KCl-cluster jet, however, Po was transported and measured in the detection system ROMA [2].

OsO_4, as a volatile compound, can be deposited at low temperatures on quartz surfaces. This technique requires much less humid gases than normally supplied, which contain approximately 100-500 ppm water.

Our recently developed gas-drying unit allows reducing the humidity to about 2 ppm. However, still a "collar" of ice deposits inside the cooled quartz spiral beginning at -70 °C. Presently, it is not clear, whether in our experiments OsO_4 was deposited on quartz or on ice. The experimentally observed absolute yield of OsO_4 as a function of temperature is shown in Fig. 4.

Further investigations will require humidity levels below 2 ppm H_2O, which can be obtained from a more efficient gas drying-unit.

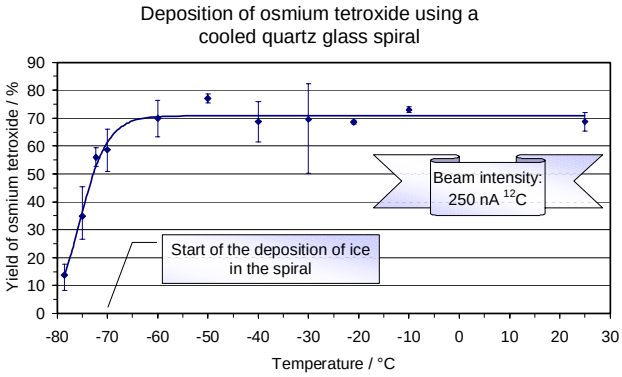

Fig. 4

Literature:

[1] A. von Zweidorf et al., GSI Scientific Report 1999, 236

[2] M. Schädel et al., GSI Scientific Report 1995, 10 ff.