

## PREPARATION OF $^{183,184}\text{Re}$ SAMPLES FOR MODELLING A RAPID GAS PHASE CHEMISTRY OF NIELSBOHRRIUM (Ns), ELEMENT 107

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*Chemical gas phase reactions of the heavier group 7 elements in the system  $\text{O}_2/\text{H}_2\text{O}$  are presumably best suited for a separation of Nielsbohrium from the lighter transactinides. We expect a higher reaction velocity using the more reactive gas system  $\text{O}_3/\text{H}_2\text{O}_2$ . For the experimental verification of this idea we prepared  $^{183}\text{Re}/^{184}\text{Re}$  samples for thermochromatography experiments with both gas systems.*

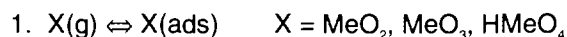
Shell deformation effects in the ground state, which were calculated for the heaviest elements ( $Z \geq 104$ ) are responsible for an increase of the fission barrier [1]. In the  $N = 162$  region longer-lived isotopes of the heaviest elements are expected [2]. These predictions motivated us to plan on-line gaschromatography experiments with Nielsbohrium. The probably low production cross section of the  $^{254}\text{Es} (^{16}\text{O}, 4n)^{266}\text{Ns}$  reaction [3] and the predicted short half-life of 2-20 s of  $^{266}\text{Ns}$  define a set of tasks to be solved:

- A) Investigate other production reactions such as  $^{249}\text{Bk} (^{22}\text{Ne}, 4/5n)^{267,266}\text{Ns}$ , as used in [4].
- B) Develop a rapid on-line chemistry which has a high separation factor of Nielsbohrium compounds from contaminating species (i.e. of the lighter transactinides) in the chosen chemical system and – if possible – use a chemical reaction that leads to well-defined molecules in order to interpret the Ns-chemistry.

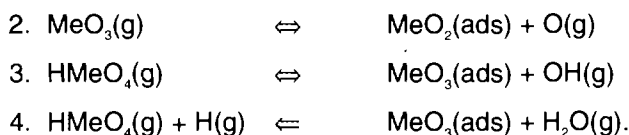
In gaschromatographic experiments the gas systems  $\text{O}_2$  and  $\text{O}_2/\text{H}_2\text{O}$  are well suited to solve the chemical tasks [5,6]. The most probable compounds in these systems with carrier free amounts of group 7 elements are  $\text{MeO}_2$ ,  $\text{MeO}_3$  and  $\text{HMeO}_4$ .

Before starting a Nielsbohrium experiment we need some information about the behaviour of the Nielsbohrium homologues (Re, Tc) in the proposed chemical systems. Therefore, thermochromatographic experiments are very useful.

In literature studies about gas phase chemistry of group 7 element compounds [3,4,6,7] the experimental data were interpreted with a simple mobile transport of the molecules X:



In our opinion the following molecular transport reactions are conceivable too:



A crucial point is a fast reaction kinetic in order to enable a fast separation of short-lived nuclides. We therefore propose the use of reactive gases, for example  $\text{O}_3$  and  $\text{H}_2\text{O}_2$ . The relevant group 7 element

compounds are the same. The more reactive chemical system with  $\text{O}_3/\text{H}_2\text{O}_2$  is expected to increase the velocity of the formation of compounds and of the transport mechanisms 2-4.

For thermochromatography experiments we prepared carrier-free, long-lived Re-nuclides using the PSI Philips-cyclotron. A tungsten target was irradiated with a 70-MeV proton beam. The optimum proton energy for the nuclear reaction  $W_{\text{nat}}(\text{p}, \text{xn})^{183,184}\text{Re}$  is about 30 MeV [8]. We degraded the primary energy with a 5 mm Cu sheet in front of the target. Using a sandwich target of 6 tungsten sheets, each 300  $\mu\text{m}$  in thickness, we got samples with different Re activities. The separation of the  $^{183,184}\text{Re}$  from the W matrix was performed by thermochromatography with dry air in  $\text{SiO}_2$  columns [6]. We achieved a complete separation of Re from the oxidized tungsten matrix. About one third of the Re – probably  $\text{ReO}_3$  – was deposited at high temperatures close to the heating device. Despite a thorough drying of the transport air in  $\text{H}_2\text{SO}_4$  (96 %) and with molecular sieve the remaining Re formed a volatile compound – probably  $\text{HReO}_4$ . Most of this compound was stopped on a quartz wool plug at the end of the column kept at room temperature. After the separation process we leached the Re-containing part of the quartz column including the quartz wool plug with ammonia (25 %). To get dry samples for easy handling during the thermochromatographic experiments thin quartz filter stripes were drenched with the solution and then dried in a desiccator.

### REFERENCES

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