

Development of high-temperature chromatography for heaviest elements

G. Tiebel^{1,2}, J. Wilson^{1,2}, M. Carulla Areste³, M. Carmada⁴, R. Dressler¹, P. Steinegger^{1,2}

¹*Laboratory of Radiochemistry, Paul Scherrer Institut, Villigen PSI, Switzerland*

²*Laboratory of Inorganic Chemistry, ETH Zürich, Zürich, Switzerland*

³*Laboratory for X-ray Nanoscience and Technologies, Paul Scherrer Institut, Villigen PSI, Switzerland*

⁴*SenSiC, Park INNOVAARE, Villigen, Switzerland*

Online gas-adsorption thermochromatography experiments have been successfully used for the chemical characterization of superheavy elements at the one-atom-at-a-time level [1]. In these experiments, the covered temperature range, applied along the chromatographic channel, defines which chemical elements or associated compounds can be investigated on the provided stationary phase. As the gas-chromatographic channel of state-of-the-art experiments consists of Si-based semiconductor solid-state detectors for time-resolved, event-by-event α - and fission fragment spectroscopy, experimentalist face an upper temperature threshold of approximately 50°C. Hence, they are currently limited to comparably volatile chemical species such as elemental copernicium and flerovium. Single-crystal, chemical vapor deposition diamond and 4H-SiC are two promising wide bandgap semiconductors, suitable to extend the technique towards less volatile chemical species by increasing the starting point temperature of the negative temperature gradient.

Here, we present the results of continued measurements targeting the spectroscopic response of 4H-SiC-based sensors for α -spectroscopy up to 500°C [2] and beyond to 700°C. In addition to the general spectroscopic behavior of the sensors, we will address additional difficulties, such as the electrical contacting of the sensors at higher temperatures.

References

- [1] A. Türler *et al.*, Nucl. Phys. A **944**, 640-689 (2015)
- [2] C. Weiss *et al.*, Nucl. Instrum. Methods Phys. Res., Sect. A **1040**, 167182, (2022)