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Chemical identification of element 114 at TASCA

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The newly built gas-filled separator TASCA, at the GSI Darmstadt has been successfully commissioned. TASCA was designed to study the physics and chemistry of the heaviest element and it has been demonstrated that TASCA is the most efficient device for the production of superheavy elements in complete fusion reactions with a ^{48}Ca ion beam. Two experiments on the physics and chemistry of element 114, produced in the $^{244}\text{Pu}(^{48}\text{Ca};3\text{-}4\text{n})^{288,289}\text{114}$ reaction, were performed at TASCA in 2009 in the framework of the international TASCA collaboration. 17 decay chains from element 114 were detected. The decay properties of $^{288,289}\text{114}$ and the high cross sections reported by Oganessian et al. [1] have been confirmed. Here, we report on the results of the experiment on the chemistry of element 114 that was performed at TASCA in September 2009. Evaporation residues (EVRs) of element 114 were produced in the irradiation of a ^{244}Pu target ($\sim 580 \text{ ug/cm}^2$) with ^{48}Ca ions at an excitation energy of 42 MeV. The EVRs were separated in TASCA, which was operated in the Small Image Mode [2]. They then passed through a 3.3 μm Mylar window (30 x 40 mm^2) into a Recoil Transfer Chamber (RTC) of 29 cm^3 in volume made from Teflon. The atoms were thermalized in the RTC in a He/Ar gas mixture (7:3) and then flushed into the COMPACT detector [3], which was directly connected to the exit of the RTC. Two chromatography channels made from 32 pairs of PIN diodes covered with a thin gold layer were connected in series: the first one was kept at the room temperature, and the second one had a negative temperature gradient from +20 to -160C. This allowed efficient detection of chemical species with different volatilities: from non-volatile Pb to very volatile Rn. The distribution of Pb and Hg in COMPACT was measured in separate experiments with short-lived Pb and Hg isotopes that were pre-separated in TASCA. For monitoring the detection system, a small amount of ^{219}Rn was added to the carrier gas and was responsible for alpha particle background in spectra. No other peaks from alpha particles were found. Two decay chains from element 114 were detected: one from $^{288}\text{114}$ and one from $^{289}\text{114}$ produced in 4n and 3n evaporation channels, respectively. Both decays from element 114 isotopes were observed in the first detector channel, held at room temperature. From this observation, we can conclude that element 114 is less volatile than element 112 and more similar to Hg. This is in agreement with theoretical predictions [4] and contradicts previous chemical experiments with element 114 as performed by the PSI group at FLNR Dubna [5].

References

- [1] Yu. Ts. Oganessian, J. Phys. G 2007, 34, R165-R242 (2007).
- [2] A. Semchenkov et al. NIM B 266 (15), (2008).
- [3] J. Dvorak et al. Phys. Rev. Lett. 97 242501 (2006).
- [4] V. Pershina et al. J. of Chem. Phys. 131 083713 (2009).
- [5] R. Eichler, submitted to Radiochim. Acta.

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