Chemical studies of Fl (element 114) – heaviest chemically studied element

L. Lens[1,2]

for a U. Mainz - GSI Darmstadt - HIM Mainz - JAEA Tokai – U. Liverpool - LLNL Livermore – UNLV . - Lund U. - RIKEN Wako - SINP Kolkata - IITR Uttarakhand - ANU Canberra – U. Oslo – U. Jyväskylä - ITE Warsaw - collaboration

(The TASCA flerovium chemistry collaboration)

[1]*Institut für Kernchemie, Johannes Gutenberg Universität Mainz, 55099 Mainz, Germany*

[2]*GSI Helmholtzzentrum für Schwerionenfoschung GmbH, Planckstr. 1, 64291 Darmstadt*

The atomic properties of transactinide elements are pronouncedly influenced by strong relativistic effects [1]. The heaviest element under current chemical study is flerovium (Fl, element 114). Early atomic calculations indicated this to be chemically inert, similar to noble gases [2]. More recent relativistic calculations suggest a distinct metallic character, but lower reactivity than its lighter homolog, Pb [3]. Experimental studies are challenging due to low production rates and short half-lives. In addition, a wide volatility range, from the rather reactive and non-volatile metal Pb, to the inert and noble gas Rn, has to be covered, and detection of single atoms has to be achieved. For the latter, the use of a physical pre-separator is advantageous, as it provides a significant background reduction.

Based on the observation of three radioactive decays attributed to Fl in a first Fl chemical study performed by a PSI-FLNR collaboration, a weak interaction with gold was inferred [4]. In a second study, performed by a collaboration working at the TASCA preseparator at GSI, Darmstadt, two Fl atoms were observed. The results pointed to the formation of a metal-metal bond of Fl with gold, but the limited statistics allowed to derive only a lower limit for the interaction strength. [5]. The contradicting results called for advanced studies. Additional experiments performed by the PSI-FLNR collaboration, did not result in Fl observation [6].

Two new experimental campaigns were performed at TASCA in 2014 and 2016, where further Fl atoms were observed. In this talk, the current status of chemical studies of Fl will be discussed.

References

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