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# On the way to the synthesis of the first transactinide carbonyl complex

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Until now gas phase chemical studies of transactinides (TANs) focused on simple, inorganic compounds. The harsh conditions behind the target (plasma and heat) in general prevented direct synthesis of, e.g., organometallic compounds. In the last years, this limitation could be overcome by the combination of a physical recoil separator with chemistry setups. [1]
We report here on initial experiments with this technique that focused on metal-carbonyl complexes. Seaborgium hexacarbonyl has been predicted to be stable. [2] The pi-back bonding, characteristic for the metal-carbon bond in carbonyls, should be stronger than in the complexes formed with the lighter homologues due to the relativistic expansion of the d-orbitals.[2] On the way to experiments with Sg, studies of its lighter homologues were performed. Suitable isotopes of Mo were produced in neutron-induced fission of Cf-249 at the TRIGA reactor Mainz. "Hot"recoil atoms formed volatile complexes upon thermalization in a CO containing atmosphere. The complexes could be rapidly transported in the gas stream to counting or gas chromatography setups. [3] At the UNILAC accelerator at GSI, the gas-filled recoil separator TASCA [4] was used to study the synthesis and chemical properties of tungsten and osmium carbonyl complexes, using conditions directly applicable in a TAN experiment. [3]
This new chemical system promises to give access to a new TAN compound class. Furthermore, it could be used to provide clean of, e.g., Sg isotopes with half-lives of at least a few seconds for nuclear reaction and nuclear structure studies. Elucidation of the experimentally found, but theoretically unexplained isomeric state in Sg-265 [5,6] will be the goal of first experiments.

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[2] C. S. Nash, B. E. Bursten, J. Am. Chem. Soc. 1999,121, 10830-10831.
[3] J. Even, et al., Inorg.Chem. 2012, 51, 6431-6422.
[4] A. Semchenkov et al., Nucl. Instr. Meth. B.2008, 266, 4153-4161.
[5] Ch.E. Düllmann, A. Türler Phys. Rev. C 2008, 77, 64320.
[6] H.Haba et al, Phys Rev. C 2012, 85, 024611.

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