TASCA 26
22nd Workshop on Recoil Separator for Superheavy Element Chemistry & Physics

Po and Hg adsorption on functionalized gold chips

A. M. Bukowski[a,b], A. S. Kirkland[a,b], P. Bartl[c], J. John[c], A. Yakushev[d,e], V. Zach[f] and C. M. Folden III[a,b]

[a] *Cyclotron Institute, Texas A&M University, College Station, Texas 77843 USA*
[b] *Department of Chemistry, Texas A&M University, College Station, Texas 77843 USA*
[c] *Department of Nuclear Chemistry, Faculty of Nuclear Sciences and Physical Engineering, Czech Technical University in Prague, 115 19 Prague, Czech Republic*
[d] *SHE Chemistry Dept., GSI Helmholtzzentrum für Schwerionenforschung, 64291 Darmstadt, Germany*
[e] *SHE Chemistry Section, Helmholtz Institute Mainz, 55099 Mainz, Germany*
[f] *Nuclear Physics Institute, Czech Academy of Sciences, 250 68 Řež, Czech Republic*

Experiments studying the adsorption enthalpies of superheavy elements (SHEs) on various surfaces use isothermal or thermal gas phase chromatography. Typical challenges faced during these experiments include low count rates and the potential for strong adsorption of the SHEs on the surfaces, particularly Au-based surfaces. To address some of the challenges in these one-atom-at-a-time set-ups, our group has developed a method to change the interactions of heavy elements with Au-coated detectors, namely by the addition of self-assembled monolayers (SAMs). The functionalization of Au surfaces with SAMs aims to tune the adsorption of products on the detector surface, providing further information on the adsorption enthalpy of heavy elements. SAMs selectivity has been previously tested in online gas-phase experiments for Ir, Er, and At with both 1-(11-mercaptoundecyl)imidazole and 12-mercaptododecanoic acid SAMs [1], as well as with offline experiments with Po.

Recent experiments were performed in the SHEs homologues laboratory at the U120M accelerator in Řež (Czech Republic), demonstrating that ^{204,205}Po adsorption changed between a bare Au surface and a 12-mercaptododecanoic acid (MDDA) functionalized gold surface in an isothermal gas chromatography column. Continuing with ^{204,205}Po, two more SAMs were chosen to compare to the first results: benzyl mercaptan (BMT) and 1-dodecanethiol (DDT). In addition, the previously tested MDDA and bare Au surfaces were again tested, but with a more volatile element, ^{192}Hg, to determine the impact of element volatility and reactivity on SAMs adsorption. Work has begun on creating Monte Carlo simulations to model the adsorption process of Po and Hg on these surfaces. This work discusses our latest results and future plans.

Reference

[1] V. Zakusilova, E. E. Tereshatov, K. L. Childers, J. A. Mildon, J. R. Garcia, I. W. Haynes, S. M. Loftin, M. Boltoeva, C. M. Folden III, *Element sorption on thiolate-functionalized Au-coated Si detectors in isothermal online gas-phase experiments*, Nucl. Instrum. Methods Phys. Res., Sect. B **572**, 165959 (2026). doi:10.1016/j.nimb.2025.165959