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Functionalized Detectors for Superheavy Element Homolog Chemistry Experiments

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Several experiments aimed at chemical properties of superheavy elements (SHE) have studied the interactions of single atoms on the surface of Si-based solid-state α-detectors. Recent advancements include coating the detectors with thin layers, such as Au, to test the effects of different surfaces. Without advancements in α-spectroscopy, the results can be inconclusive.

To overcome this, a chemically selective technique has been developed at Texas A&M University. Au-coated Si-based solid-state α-detectors are further coated with an alkanethiolate self-assembled monolayer (SAM), which has a terminal group selected for the SHE. This has been demonstrated to work both in solution and in online experiments for Ir and Rh, homologs of meitnerium (Mt). A detector array is in development to test the efficacy of the SAM-coated detectors.

One current project is to develop a system to study livermorium (Lv) by characterization of the detector array with Po (homolog of Lv) in offline and online experiments. ^{216}Po (t½: 0.145 s, 100% α-decay) is produced in the decay chain of ^{228}Th. It is extracted into a recoil transfer chamber (RTC), to which the detector array is attached. Online, Po can produced via nuclear-fusion evaporation reactions, with a ^{40}Ar ion beam on a ^{162}Dy target, producing $^{196-198}$Po (t½: 5.8 s, 84 s, 105.6 s, 98%, 44%, 57% α-decay, respectively). The radioisotopes are separated from the primary ion beam and reaction by-products using the gas-filled recoil separator AGGIE, and are thermalized with a simple RTC (sRTC). Here, we present our latest results.

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