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Off-line single-atom gas chromatographic adsorption studies of bismuth

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In preparation of gas phase chemical experiments with element 115, we studied the chemical behavior of single short-lived bismuth atoms in rare gases (helium and argon) and in oxygen atmosphere. For that purpose, we performed off-line isothermal gas chromatography experiments at room temperature. The short-lived volatile Rn-219 precursor, provided from an Ac-227-source, was transported into the miniCOMPACT setup (mini Cryo-Online Multi detector for Physics And Chemistry of Transactinides) with different carrier gases. Chromatograms of Bi-211 were recorded as a function of various parameters like carrier gas type and gas flow rate, thus characterizing the novel miniCOMPACT detector array. This aids to optimize the conditions for future experiments with superheavy elements. All measured species deposited on the SiO₂ surface of the miniCOMPACT via diffusion-controlled deposition. Furthermore, we performed adapted Monte Carlo simulations, which account for the precursor effect, and compared them to experimental results to determine the lowest limit value of the adsorption enthalpy of bismuth on silicon dioxide.

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