SIMULTANEOUS COUNTER-ION CO-DEPOSITION: A TECHNIQUE ENABLING MATRIX ISOLATION SPECTROSCOPY STUDIES USING LOW-ENERGY BEAMS OF MASS-SELECTED IONS

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Matrix isolation spectroscopy was first developed in Pimentel’s group during the 1950’s to facilitate spectroscopic studies of transient species. Cryogenic matrices of condensed rare gases provide an inert chemical environment with facile energy dissipation and are transparent at all wavelengths longer than vacuum UV, making them ideal for studying labile and reactive species such as radicals, weakly bound complexes, and ions. Since frozen rare gases are poor electrolytes, studies of ions require near-equal populations of anions and cations in order to stabilize the number densities required for spectroscopic experiments. Many techniques for generation of ions for using in matrix isolation studies satisfy this criterion intrinsically, however when ion beams generated in external sources are deposited, the counter-ions typically arise via secondary processes that are at best loosely controlled. It has long been recognized that it would be desirable to stabilize deposition of mass-selected ions generated in an external source using simultaneous co-deposition of a beam of counter-ions, however previous attempts to achieve this have been reported as unsuccessful. The Moore group at Lehigh has demonstrated successful experiments of this type, using mass-selected anions generated from a metal cluster source, co-deposited with a balanced current of cations generated in a separate electron ionization source. This talk will focus on the details of the technique, and present some results from proof-of-concept studies on anionic copper carbonyl complexes formed in argon matrices following co-deposition of Cu\(^-\) with Ar\(^+\) or Kr\(^+\).

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