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Investigation of a ring ion trap for the production of multiply–charged cluster anions

A multipole ring-electrode trap was built for systematic studies of cluster anions. The Coulomb barrier and electron binding energies of multiply-charged metal clusters are experimentally hardly investigated. Because poly anionic metal-clusters do not exist in nature, they have to be produced in laboratories by cluster electron collision. This can be achieved by combinations of cluster sources and ion traps [1]. A method to investigate the Coulomb barrier is the production of negative charge states with precise electron energies. To do so, one needs a field free region for the cluster-electron interaction where, the cluster ions are trapped simultaneously. For this purpose a multipole ring-electrode trap [2] was built. The experiment consists of a magnetron sputter source [3], a quadrupole bender, the ring-electrode trap and a section for time-of-flight mass spectrometer (ToF MS). The sputter source is used to produce singly-charged negative metal clusters, which are guided into the trap. Cooled cluster ions can gain multiple charge states by cluster-electron interactions. For those interactions the cluster and electrons need a field free enviroment, which a ring-electrode trap provides. The reaction products can be investigated by ToF-MS. In a next step, the experiment should provide defined charge states for laser interaction experiments. The contribution will discuss the principle and design of the ring electrode trap, preliminaryion-confinement tests and corresponding mass spectra.
[1] F. Martinez et al. AIP Conf. Proc. 1521, (2013) 230.
[2] D. Gerlich Inhomogeneous RF fields (1992) III. E
[3] H. Haberland et al. Z. Phys. D, 20 (1991) 413.

Summary

A multipole ring-electrode trap was built for systematic studies of Coulomb barreiers of cluster anions. A method to investigate the Coulomb barrier is the production of negative charge states with precise electron energies. The experiment consists of a magnetron sputter source, a quadrupole bender, the ring-electrode trap and a section for time-of-flight mass spectrometer.The contribution will discuss the principle and design of the ring electrode trap, preliminaryion-confinement tests and corresponding mass spectra.

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