X-Ray Induced Intermolecular Decay Of Solvated Ions Investigated By Multi-Electron Coincidence Spectroscopy

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ABSTRACT

X-ray induced electron spectroscopy on liquid samples has made tremendous progress throughout the last decades through the development of the liquid microjet technique.

The investigation of secondary non-local ionization mechanisms such as intermolecular Coulombic decay (ICD) and electron-transfer-mediated decay (ETMD) remain challenging, however, due to the low energy of the emitted electrons. Their signal is often buried below an enormous background of slow electrons produced by scattering effects. Utilizing a magnetic bottle electron spectrometer for coincident multi-electron detection, this challenge can partially be overcome by significant suppression of the background. We present results on ICD and ETMD processes from Auger final states in prototypical solvated Mg^{2+} and Ca^{2+} ions. In Mg^{2+}, X-ray ionization of the K-shell and following Auger decay triggers a rich cascade of ICD and ETMD processes, some of which could be identified experimentally. Remarkably, they leave the ions finally in their initial state and can be regarded as catalysts for X-ray induced production of slow electrons and water cations.

In Ca^{2+}, we use resonant excitation of the 2p shell and subsequent resonant Auger decay for driving ICD. In this scenario, the emission of slow electrons and production of water cations is site- and energy-selective, with potential implications in radiation damage contexts.

REFERENCES

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