Dynamics of bond-selective chemistry initiated by low-energy electrons

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Low-energy electron-molecule resonances have an important role in chemical processes such as damage by ionizing radiation and nanofabrication of materials.[1] Avoiding or controlling these processes requires deep knowledge about the fundamental electron-molecule collisions such as inelastic scattering and dissociative electron attachment (DEA). Resonant interactions between low-energy electrons and molecules can efficiently convert electronic energy into nuclear degrees of freedom, leading to vibrational excitation, isomerization or dissociation. DEA can produce reactive neutral and ionic products, with a remarkably strong dependence on the specific resonance, and corresponding electron attachment energy. A detailed understanding of the underlying dynamics of DEA enables specific mechanisms to be described on the energy deposition by ionizing radiation, and the subsequent chemistry involving secondary electrons.

Anion fragment momentum imaging experiments and *ab initio* electron scattering theory allow the multidimensional dissociation dynamics of a transient anion to be explored in detail.[2] We address fundamental questions such how two or more resonances can produce the same anion and neutral products. Conversely, one transient anion resonance may produce two or more final states consisting of different anion or neutral species. A few examples are presented to highlight the current challenges for experimental and theoretical methods to address these questions. New results will be presented for Feshbach resonances of formic acid, where DEA exhibits remarkable site-selectivity in hydride anion loss from the formyl or hydroxyl sites.

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