Kapitel 6

Abstract

The interaction of low-energy electrons (<20 eV) with single molecules M (M=C₂F₅I, C₂F₅Br, C₂F₅I, C₃F₃H₃, CF₂Cl₂, CF₂BrCl and CF₂Br₂) and their van der Waals-clusters Mₘ is studied by means of electron-molecular crossed beam experiments coupled to mass spectrometry. The following results are obtained:

- Dissociative electron attachment to single molecules leads to different negatively charged fragments X⁻. Electron attachment to clusters additionally generates solvated anions X⁻·Mₙ as well as undissociated complexes Mₙ⁻ that include the stabilization of the monomeric anion. By increasing the partial pressure of the argon carrier gas, ternary products of the form X⁻·Mₙ·Arₖ can be also observed.

- At very low energies, the precursor anion of C₂F₅I⁻# undergoes unimolecular dissociation into I⁻ and C₂F₅. Analysis of excess energy distribution of the negative fragment indicates that 66% of the available excess energy contribute to translational energy and 34% to internal energy of the radical. Modelling the radical species as a rigid rotator, the internal energy is redistributed to rotation (15% of the total excess energy) and to vibration (19%).

- The solvated anions are found to be more abundant than the undisso-
ciated complexes. This mirrors the reaction pathway within the femto-
to picosecond time frame after electron localization in the target cluster
indicating that dissociation is preferred over collisional stabilization. In
the case of \((C_2F_3I)_m\)-clusters stabilization prevails on decomposition.

- At higher energies, solvated anions arise from inelastic electron scatte-
ring processes (self scavenging) in \((C_2F_5I)_m\)-clusters.

- Electron attachment to \((C_3F_3H_3)_m\) clusters shows a strong enhance-
ment of dissociative cross section at incident electron energies below
2 eV, while under single collision conditions, autodetachment process
overakes that of dissociative decay.

- Different products are detected indicating that intra-cluster polymer-
ization reactions in \((C_2F_3I)_m\) and \((C_3F_3H_3)_m\) induced by low energy
electrons take place.