

Fragmentation of CF₄ under 15-30keV H⁻, C⁻ and O⁻ negative ions impact

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Synopsis The experimental results are shown for the ionization and dissociation of CF₄ by impact of negative ions in the 10–30 keV/amu energy range. It is found that the molecule dissociation is more violent in double electron loss process of projectile (DL) than in single electron loss process (SL). The ionization and dissociation fractions of CF₄ are found to associate with the momentum of the impacting ions.

Negative ions, and especially their collision processes with molecules, play an important role in a number of areas. In this work, the fragment ions of CF₄ [1] are investigated by the impact of 15–30keV H⁻, C⁻, and O⁻.

Figure 1 shows our experiment setup to study the fragmentation in negative-ions–gas collisions.

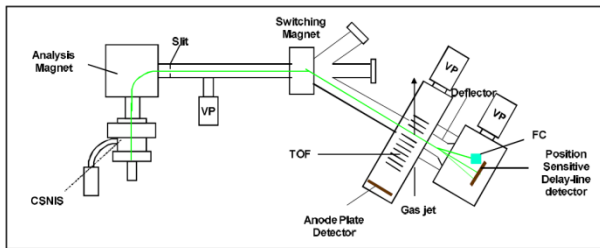


Figure 1. Experiment setup to study the fragmentation in negative-ions–gas collisions

Some conclusions are drawn:

1. It was found that the relative dissociation fractions for DL are larger than those for SL. The degree of fragmentation will become greater with a larger mass number of projectiles at the same impact energy for the same electron loss channel.

2. The ionization and dissociation fractions of CF₄ are found to associate with the momentum of the impacting ions (Figure 2), like those of N₂O [2], SF₆ [3].

3. By analyzing the peak slopes of different ion pairs in the coincidence spectra (Figure 3) of two fragment-ions, we can give the major dissociation pathways of CF₄²⁺ for 15 keV to 30 keV H⁻, C⁻ and O⁻ impact.

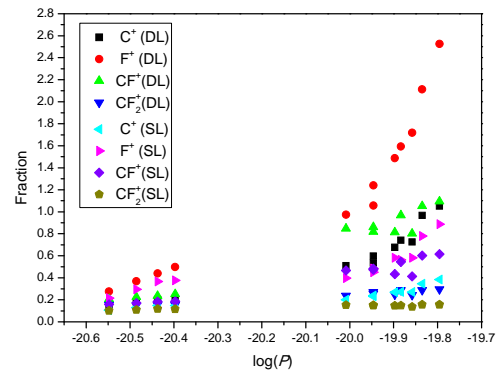


Figure 2. The relative dissociation fractions of CF₄ as a function of the momentum of impacting negative ions. The momentum P is in kg/m/s.

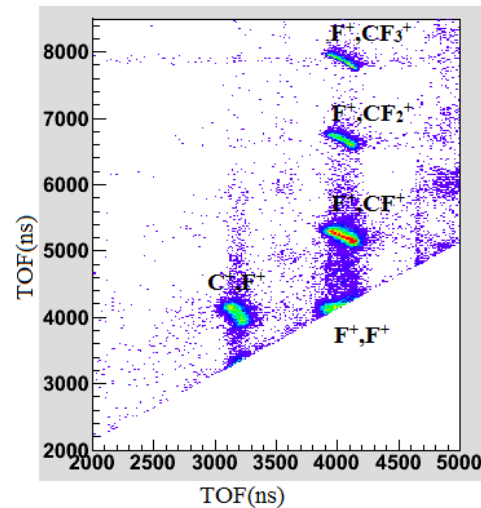


Figure 3. A coincidence spectrum (vertical axis is flight time of the second fragment ion and horizontal axis is flight time of the first fragment ion) under impact 25keV H⁻ on CF₄ for the SL channel.

References

- [1] D. Wang *et al* 2016 *J. Phys. B* 49 165201
- [2] D. Wang *et al* 2017 *Phys. Rev. A* 95, 012705
- [3] X. He *et al* 2016 *Can. J. Phys.* 94 1228

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