Fragmentation of N_2O under 15-30keV H^-, C^- and O^- negative ions impact

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Synopsis The experimental results are shown for the fragmentation of N_2O by impact of negative ions in the 15–30 keV energy range. It is found that the molecule dissociation is more violent in double election loss process of projectile (DL) than in single electron loss process (SL). We give the ratios of O^++N_2^+/N^++NO^+, and compare those with the earlier reported experimental results. And we can give the major dissociation pathways of N_2O^{2+} in 15–30 keV H^-, C^- and O^- impact by analyzing the peak slopes of different ion pairs in the coincidence spectra of two fragment-ions. Finally, we obtain the translational energy of (N+NO^+) and (O+N_2^+) in the dissociation of N_2O^+.

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 N_2O [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.

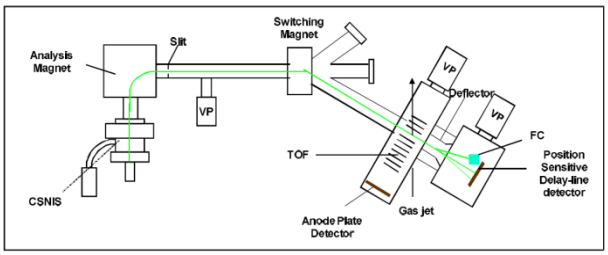

Figure 1. Experiment setup to study the fragmentation in negative-ions–gas collisions

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 N_2O are found to associate with the momentum of the impacting ions(Figure 2), like those of CF_4[2], SF_6[3].

3. Comparing the ratios of O^++N_2^+/N^++NO^+ in our work with that of Xe^{43+}[4], the ratios with H^- (Figure 3) are almost the same as that with Xe^{43+}, however the values for C^- or O^- are bigger, especially in DL process.

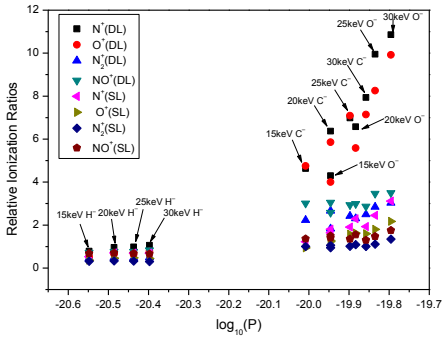

Figure 2. The relative dissociation fractions of N_2O^+ as a function of the momentum of impacting negative ions. The momentum P is in kg m/s.

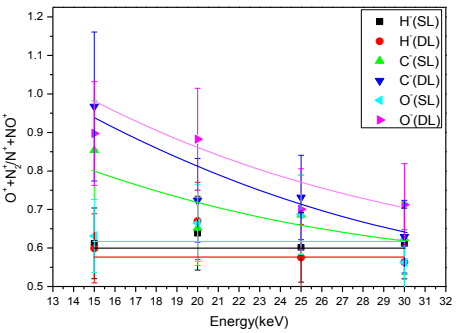

Figure 3. The ratios of O^++N_2^+/N^++NO^+ under H^-, C^- and O^- impact in 15-30keV energy region. The curves are the eye-guide lines.

References

[1] D. Wang *et al* 2017 *Phys. Rev. A* accepted
[2] D. Wang *et al* 2016 *J. Phys. B* 49 165201
[3] X. He *et al* 2016 *Can. J. Phys.* 94 1228
[4] B. Siegmann *et al* www.gsi.de/scirep2006/PAPERS/ATOMIC-PHYSICS-11.pdf

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