Dissociative electron attachment to chlorine dioxide probed by velocity slice im-aging

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Dissociative electron attachment to chlorine dioxide probed by velocity slice imaging

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Synopsis We report the study of dissociative electron attachment (DEA) to chlorine dioxide (OClO) in the energy range of 1 to 10 eV using velocity slice imaging technique. DEA to OClO shows Cl^-, O^-, O_2^-, and OCl^- as fragment channels at various electron energies. Based on the momentum images of these ions we unravel the molecular dynamics leading to DEA.

Chlorine dioxide (OClO) is an important molecule in atmospheric chemistry as a major source of atomic chlorine in the stratosphere as it decomposes photo-chemically forming O_2 as the other product. Dissociative electron attachment (DEA) to OClO can also lead to atomic chlorine formation.

DEA to OClO has been studied in the past with reports of absolute cross-section measurements [1]. However, the dynamics that leads to DEA has not been reported so far. Here we report the study of DEA dynamics for OClO using velocity slice imaging technique.

We observed Cl^-, O^-, O_2^-, and OCl^- ions from the DEA measurements on OClO formed at various electron energies. The OCl^- being the most dominant channel was found to peak around 0.7 eV, whereas Cl^- and O_2^- signals peaked around 0.7 eV, 4 eV, 8 eV. Out of these the peak at 0.7 eV was found to be the dominant peak. The O^- ion yield was found to peak at 1.2 eV, 4 eV, 8 eV.

We carried out the momentum imaging of various fragment ions across different resonances using velocity slice imaging [2]. The VSI spectrometer was modified with longer flight tube and larger (75 mm diameter) phosphor screen based position sensitive detector [3]. For each of the ion fragments, we obtained the kinetic energy and angular distribution data. The velocity slice images obtained for Cl^- channel at 8 eV is shown in Fig. 1 as an example. For Cl^- channel, with very low energy threshold (-3.37 eV) [1], it was expected to carry good amount of kinetic energy from the 8 eV resonance. However, the low kinetic energy observed in Cl^- channel indicates an interesting many body fragmentation dynamics behind the DEA process. The angular distribution also shows a forward-backward asymmetry.

In this poster we will describe the dynamics involved in DEA to OClO based on the kinetic energies and angular distributions measured using velocity slice images for all the fragments observed at various resonances.

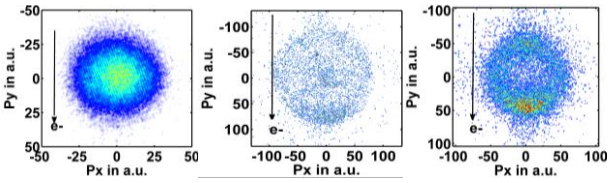

Figure 1. Momentum image of OCl^-, O^- and Cl^- from OClO at 0.7eV, 4eV and 8eV electron energy respectively.

References

[1] Gilbert Senn et al. 1999 *J. Phys. B At. Mol. Opt. Phys.* **32** 3615
[2] Dhananjay Nandi, Vaibhav S. Prabhudesai, E. Krishnakumar and A. Chatterjee 2005 *Rev. Sci. Instrum.* **76** 053107
[3] Ewelina Szyman´ska, Vaibhav S. Prabhudesai, Nigel J. Mason and E. Krishnakumar 2013 *Phys. Chem. Chem. Phys.* **15** 998

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