THE MEASUREMENT OF ELECTRON AND ION SWARMS TRANSPORT AND REACTIVITY: CURRENT STATE AND FUTURE CHALLENGES

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Abstract. There is an increasing need of electron and ion swarm data due to the multiple industrial and fundamental applications of low-temperature plasma physics, such as materials processing, plasma medicine, biomolecules, atmospheric and high voltage insulation. Plasma simulation plays nowadays a fundamental role in the design of reactors for semiconductor fabrication and many other applications in which knowledge of either electron and ion swarm transport parameters such as drift velocity, Casey et al. 2019, and diffusion, on the one hand, and reactive processes such as ionization (electron impact, Penning, positive ion impact on surfaces and photon ionization in the realm of the gas), electron attachment and detachment and, on the other hand, a large number of ion-molecule reactions which play a fundamental role in the development of the plasma. The measurement and calculation of electron/ion-molecule cross sections are also essential for the above purposes. The link between electron/ion swarm coefficients and cross sections will be discussed. New gases for industrial applications and biomolecules have recently appeared, de Urquijo et al. 2019, J, Casey M.J.E. et al: 2019, González-Magaña et al. 2018, demanding the measurement and calculation of the cross sections involved the evolution of the plasma.

This talk reviews the present status of the experimental methods and analytical techniques to measure the above coefficients, their advantages and limitations, and also the collision cross sections derived from the measured swarm parameters. A particular emphasis will be placed in the discussion of the experimental limitations and suggest means to overcome some of them and expand the realms of measurement and accuracy of the above transport properties.

References

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