

## Mass and energy spectra of ions in cold plasmas to identify their active species and kinetic processes.

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Quadrupole mass spectrometry finds extensive application for the identification of ions in plasmas. Mass spectra of ions are not affected by the fragmentation problems of neutrals at the detector; nevertheless, ions with equal mass/charge ( $m/q$ ) ratio but different composition can contribute to the same peak [1]. This can be a problem for plasmas of gas mixtures that lead to different products, but additional insight can be derived from their ion energy distributions,  $f(E)$ .

In hollow cathode discharges, where the potential fall in the negative glow is negligible, these distributions are largely determined by the acceleration of the ions in the sheath region between the negative glow and the cathode; but they may also carry specific information about ion generation mechanisms within the plasma or about collision processes in the sheath, which can in turn be useful to identify different ions with the same  $m/q$  ratio. At low pressures, these ion energy distributions are mainly characterized by a narrow ( $\text{FWHM} < 2 \text{ eV}$ ) maximum close to the value of the anode-cathode potential, which indicates that most ions are accelerated from the plasma edge towards the cathode through a largely collisionless sheath [2]. However, "wings" of variable magnitude characteristic for the different ions appear at the basis of the narrow maxima and, in some components, somewhat broader distributions (tens of eV) are observed [3, 4].

Diverse ion energy distributions observed in hollow cathode DC discharges corresponding to various mixtures of  $\text{H}_2$ ,  $\text{CH}_4$ ,  $\text{N}_2$ ,  $\text{O}_2$ ... will be presented at the conference, and likely causes for the observed shape differences in  $f(E)$  will be advanced.

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