DETERMINATION OF ION FLUX IN Ar, O_2, CF_4 AND SF_6 ASYMMETRIC CAPACITIVE DISCHARGES THROUGH INVASIVE AND NON-INVASIVE METHODS

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The measurement of ion flux to the bias-electrode in contact with the plasma is an important parameter for characterization of processes assisted by energetic reactive ions [1]. However, the experimental determination of this flux is not a trivial task causing it to be theoretically estimated in most cases. In this work, the ion flux in the bias-electrode of an asymmetric capacitive discharge was estimated by three different methods: i) a non-invasive experimental method proposed by Mateev et al. where the ion flux is estimated from a theory that uses the radio-frequency (rf) power versus V_{dc} curve data [2]; ii) an invasive method through Langmuir probe measurement, which are determined the ion density at the sheath edge of self-polarized electrode and the electron temperature and subsequently they are replaced in the expression of ion flux: $\Gamma_i = n_s\sqrt{kT_e/m_i}$ and iii) theoretically through estimates by global model based in theory presented by Thorsteinsson et al. [3]. The gases used in this investigation were the Ar, O_2, CF_4 and SF_6. Also, we consider the effect of variation of gas pressure (5-100 mTorr), mass flow rate (1-100 sccm) and rf power (10-200 W). The results show a good agreement between the methods (i) and (iii) for both gases investigated. The method (ii) gives overestimated ion flux values at low powers, probably due to errors arising from the Langmuir probe ion theory used to determine the n_+ since at these conditions the generated plasmas presented non-Maxwellian EEDFs.

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* This work was supported by the Brazilian National Council of Research and Development (CNPq).