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O2.303 Influence of the gas-flow on the thermodynamic equilibrium of atmospheric-pressure microwave plasmas

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Microwave plasmas sustained at atmospheric pressure are applied in many fields due to the flexibility and high chemical reactivity that result from non-equilibrium operation conditions. However, the performance of a plasma in a specific technological application is determined by the density of active species and their characteristic temperatures, which are interrelated by the thermodynamic equilibrium (TE) degree of the discharge. Though many studies have dealt with the impact of experimental conditions on TE, only few of them have focused on the impact of gas-flow [1]. In the present study, the influence of gas-flow in the axial distribution of plasma parameters along an atmospheric-pressure microwave argon capillary plasma sustained using a surfaguide [2] has been examined. Increasing gas-flow results in a reduction of gas and electron temperatures, as well as of electron density. Besides, important asymmetries in the axial distribution of some excited states appear (Figure 1). This can be explained by the dependence of these parameters on the dynamics of argon molecular ions, which is strongly affected by the decrease in gas temperature. Finally, increasing gas-flow affects TE degree too, leading more of the lower levels of argon out of partial Local Saha Equilibrium, although their population is still controlled by collisional processes.

[1] Martínez J, Castaños-Martínez E, González-Gago C, Rincón R, Calzada MD Muñoz J, Plasmas Sources Sci. Technol. 27 (2018) 077001
[2] Moisan M, Etemadi E and Rostaing J C 1998 French Patent No. 762748 European Patent No. EP.

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