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Surface wave discharge in helium: evolution of metastable density and temperatures with operating parameters AHMAD HAMDAN, JOELLE MARGOT, University of Montreal, FRANÇOIS VIDAL, INRS, PLASMA PHYSICS TEAM, EMT TEAM — Metastable and resonant-state atoms play an important role in the kinetics of gas discharges (*e.g.* stepwise ionization and excitation processes). In this contribution, we study a surface-wave discharge in helium. Properties of the plasma such as metastable density, gas temperature and excitation temperature were studied as a function of the operating parameters (pressure, power and axial position z). Rotational temperatures of OH, NH and N_2^+ (impurities) are estimated by fitting the experimental rotational spectra by synthetic spectra. It was observed that the rotational temperature of N_2^+ is far to be in thermal equilibrium with the gas. The temperature of the latter T_g is better described by the rotational temperature of the OH radical. Its evolution was studied as a function of z, power and pressure. T_g was found to change from 400 to 1000 K, depending of discharge conditions. The excitation temperature was estimated to be about 0.55 eV using the Bolzmann plot method. The corresponding electron temperature and density were assumed to be 3 - 4 eV and 1 - 4 10^{12} /cm^3, respectively, based on the results of collisional-radiative models presented in literature. The metastable density n* in the 2^3S level was determined using absorption spectroscopy. It was observed that n* depends neither of the power nor of the axial position. However, an important dependence of the pressure was observed. n* decreases from 10^{11} to 10^{10} /cm^3 when the pressure increases from 5 to 50 Torr.

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