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P4.3015 Self-consistent Electron Energy Distribution Functions in Reacting CO2 discharge and post-discharge conditions

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Large attention is nowadays devoted to the understanding of the activation of CO_2 by cold plasmas in different conditions (MW, DBD, nano-pulsed discharges). Theoretical efforts are being developed to better understand the electrical conditions necessary for maximizing the CO_2 dissociation process [1-2]. In particular, Bogaerts et al. [1] concentrated their efforts on the vibrational plasma kinetics, while Pietanza et al. [2] devoted particular attention to the development of the electron energy distribution function (eedf) in pure CO_2 and CO plasmas. In this contribution, we present new results for MW CO_2 reacting mixture, emphasizing the role of CO_2 and CO species in affecting the eedf through their non-equilibrium vibrational distributions, as well as their concentration of electronic states. Vibrational and electronic states play an important role in superposing structures in eedf especially in the post-discharge regime due to the action of superelastic collisions. A sample of results is reported in the following figure for discharge (a) and post-discharge (b) conditions characterized by the following values: P=20 torr, Tg=300 K, power density W=80 W/cm^3, discharge time td=50 ms, post-discharge time tpd=800 ms). The role of excited states in affecting eedf is well evident in the postdischarge regime where the plateau created by the CO_2 metastable at 10.5 eV and a multitude of peaks mainly due to the electronic states of CO clearly appear, these structures being hidden under discharge conditions by the applied field.

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