

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

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See full abstract here:

<http://ocs.ciemat.es/EPS2019ABS/pdf/P4.3015.pdf>

Large attention is nowadays devoted to the understanding of the activation of CO₂ 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 CO₂ 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 CO₂ and CO plasmas. In this contribution, we present new results for MW CO₂ reacting mixture, emphasizing the role of CO₂ 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, T_g=300 K, power density W=80 W/cm³, discharge time t_d=50 ms, post-discharge time t_{pd}=800 ms). The role of excited states in affecting eedf is well evident in the postdischarge regime where the plateau created by the CO₂ 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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2. L.D. Pietanza, G. Colonna, G. D'Ammando, A. Laricchiuta, M. Capitelli Phys. Plasmas 23 (2016) 013515; M. Capitelli, G. Colonna, L.D. Pietanza PSST 26 (2017) 055009; L.D. Pietanza, G. Colonna, M. Capitelli PSST 27 (2018) 095004

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