GEC16-2016-000470

Abstract for an Invited Paper
for the GEC16 Meeting of
the American Physical Society

Selfconsistent vibrational and free electron kinetics for CO_2 dissociation in cold plasmas

The activation of CO_2 by cold plasmas is receiving new theoretical interest thanks to two European groups [1-2]. The Bogaerts group developed a global model for the activation of CO_2 trying to reproduce the experimental values for DBD and microwave discharges. The approach of Pietanza et al was devoted to understand the dependence of electron energy distribution function (eedf) of pure CO_2 on the presence of concentrations of electronically and vibrationally excited states taken as parameter. To understand the importance of the vibrational excitation in the dissociation process Pietanza et al compared an upper limit to the dissociation process from a pure vibrational mechanism (PVM) with the corresponding electron impact dissociation rate, the prevalence of the two models depending on the reduced electric field and on the choice of the electron molecule cross section database [2]. Improvement of the Pietanza et al model is being considered [3] by coupling the time dependent Boltzmann solver with the non equilibrium vibrational kinetics of asymmetric mode and with simplified plasma chemistry kinetics describing the ionization/recombination process and the excitation-deexcitation of a metastable level at 10.5eV. A new PVM mechanism is also considered. Preliminary results [3], for both discharge and post discharge conditions, emphasize the action of superelastic collisions involving both vibrationally and electronically excited states in affecting the eedf. The new results can be used to plan a road map for future developments of numerical codes for rationalizing existing experimental values, as well as, for indicating new experimental situations. [1] T.Kozak, A.Bogaerts Plasma Sources Sci. Technol. 24, 042002 (2015); [2] L. D. Pietanza, G. Colonna, G. D'Ammando, A. Laricchiuta and M. Capitelli, Plasma Sources Sci. Technol. (Fast Track Communication) 24, 042002 (2015); J.Phys.Chem.A 120, 2614(2016); [3] L. D. Pietanza et al. Plasma Phys. Control. Fusion (2016) submitted