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**Vibrational kinetics of non-equilibrium $CO_2$ plasma discharge in low-excitation regime**[1] M GROFULOVIC, T SILVA, V GUERRA, IPFN/IST, Universidade de Lisboa (Portugal), C D PINTASSILGO, Departamento de Engenharia Fsica, FEUP, Universidade do Porto (Portugal) , B L M KLARENAAR, R ENGELN, Department of Applied Physics, TU/e - Eindhoven (Netherlands), A S MORILLO-CANDAS, O GUAITELLA, LPP, Ecole Polytechnique, UPMC, Universit Paris Sud-11, CNRS - Palaiseau (France) — The main purpose of this work is to understand in detail the vibrational energy exchanges in non-equilibrium $CO_2$ plasmas. To that end, we develop a kinetic model that couples the electron Boltzmann equations to the rate balance equations describing the time evolution of various individual vibrational levels of $CO_2$(X $1\Sigma+$). We have investigated a low excitation regime, where $\nu_2^{max} = 5$, $\nu_3^{max} = 5$ and $\nu_1^{max} = 2$, resulting in 72 vibrationally excited levels. Validation of the model was done by comparing the time-dependent densities of the aforementioned states with measurements obtained by time-resolved in situ FTIR spectroscopy in a pulsed $CO_2$ dc discharge (at p = 5 Torr, I = 50 mA) and its afterglow. The calculated maintenance electric field during the pulse and the time-dependent populations are in excellent agreement with the measured values. Work is in progress to extend the study to the higher vibrational excitation.

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