A REACTION MECHANISM FOR VIBRATIONALLY COLD CO_2 PLASMAS

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Abstract. The use of plasmas for CO_2 utilization has been under investigation in recent years following a wave of environmental awareness. In this work we research this topic using a bottom-up strategy to study fundamental CO_2 plasma processes. For this we rely on modelling and on dedicated experiments with which a reaction mechanism for vibrationally cold CO_2 plasmas can be validated in a relatively large range of experimental conditions. The simulation tool we use, LoKI (see Tejero-del-Caz *et al.* 2019), couples a Boltzmann and a chemistry solver. The simulated results obtained with the mechanisms proposed are validated against CO_2 glow discharge measurements at pressures lower than 5 Torr, reduced electric fields ranging from 50 to 100 Td and flowing at few sccm (see Morillo-Candás *et al*. 2019). The model can reproduce the measured values of product formation as well as discharge power and electric field. Although vibrational populations are low, we show them to have a significant effect on the electron properties. The shape of the EEDF is also significantly dependent on the dissociation degree. Moreover, we discuss the role of electronically excited states on CO_2 dissociation, showing that the first electronic excited state of CO can have beneficial effect in further producing CO and O in the discharge.

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