# Kinetic mechanisms in $CO_2$-$N_2$ plasmas

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This contribution reports the comparison of simulation results from a 0D self-consistent kinetic model with recent experimental data obtained in low-pressure DC discharges. This comparison allows the development of a new reaction mechanism (i.e., a set of reactions and rate coefficients validated against benchmark experiments) for $CO_2$-$N_2$ plasmas.

Investigating the impact of $N_2$ on the overall $CO_2$ conversion is relevant as $N_2$ can be present as an impurity in industrial $CO_2$ emission and can be used to promote $CO_2$ vibrational excitation. The system of election is a DC glow discharge, operating at pressures in the range p=0.1-10 Torr and discharge currents I=10-50 mA, in a Pyrex tube of radius R=1 cm, which is stable, axially homogenous, and easily accessible to a variety of diagnostics. The set of measurements provides the gas temperature, vibrational temperatures of $CO_2$, reduced field E/N, and densities of O(3P), NO, $NO_2$, CO($X^1\Sigma^+$) and $CO_2$($X^1\Sigma^+_g$). The simulation results are obtained with the LoKI (LisbOn Kinetics) [1] simulation tool solving a Boltzmann-chemistry global model.

The admixture of $N_2$ has a beneficial impact on $CO_2$ decomposition [2,3]. Several reasons can be assigned to it, one of them being the transfer of vibration quanta from the first vibrational level of $N_2$ to the asymmetric mode of $CO_2$ and the fact that vibrationally excited $CO_2$ can undergo molecular dissociation through the so-called ladder climbing mechanism or by electron impact stepwise processes. The dilution with $N_2$ can also limit the influence of back reaction mechanisms producing back $CO_2$ from CO. These mechanisms will be discussed in the detail at the conference. Understanding the impact of the different processes on the overall kinetics, along with the validation against experimental data, will contribute to further develop the existing models [3-5] and to better control and enhance $CO_2$ conversion.

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