Keep-in-Touch meeting
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Nanosecond Resolved Vibrational Kinetics of CO2 in CO2/N2 Mixtures Measured in a Pulsed Discharge Jet

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Discharges in CO_2 and their vibrational kinetics have been in the focus of intensive research recently for potential applications such as the efficient dissociation and conversion of CO_2 via a vibrational pathway and due to the importance of the vibrational kinetics of CO_2 for the understanding of gas heating and atmospheric re-entry. CO_2/N_2 mixtures are an important subject of study due to the presence of N_2 in waste gas streams and the quasi-resonant vibrational energy transfer between the two molecules, which was historically important for CO_2 lasers. The challenge of understanding and utilizing different vibrational pathways is the large number of processes involved, which include the transfer of energy between electrons and vibrational states (e-V), the transfer of energy between different the vibrational modes of CO_2 and other molecules (V-V) and the transfer between vibrational and translational degrees of freedom (V-T).

In this work, a ns-pulsed near-atmospheric pressure plasma jet operated in a CO_2/N_2 mixture is studied. Absorption spectroscopy using a quantum-cascade-laser (QCLAS) is used to measure the densities of vibrationally excited CO_2 molecules with nanosecond resolution. These studies are complemented by measurements using electric field induced second harmonic generation (E-FISH) and electrical measurements to characterize the discharge. The nanosecond pulsing, combined with fast diagnostics, allows for a temporal separation of processes on different timescales, namely, electron impact excitation (e-V) during the discharge and vibrational-vibrational (V-V) and vibrational- translation (V-T) transfer in the afterglow.

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