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Vibrational excitation of CO2 by Nanosecond Repetitively Pulsed sparks ERWAN PANNIER, VALENTIN BAILLARD, CHRISTOPHE LAUX, CentraleSupelec — CO_2 can be used as a feedstock for synthetic gas (syngas) production, both for ground and space (Mars settlement) applications. In these processes, CO_2 splitting into CO and O_2 is the most energy consuming step. Previous studies have shown that nonequilibrium plasma discharges can perform this dissociation with a maximum energy efficiency through the excitation of vibrational levels of CO_2 in a process known as the ladder-climbing mechanism. In this work, we investigate the contribution of vibrational excitation in CO_2 dissociation with nanosecond repetitively pulsed discharges (NRP). In particular, we investigate the potential of the high repetition frequency (10 - 20 kHz) to yield a synergetic effect that increases the vibrational temperature over several pulses. The vibrational excitation of CO_2 is measured with time-resolved, phase-locked IR emission spectroscopy in the 4.2um asymmetric stretch band. The vibrational temperature is inferred from a comparison with non-equilibrium spectra calculated with the CDSD-HITEMP database. Populations of vibrationally excited states are compared with results from a 0D vibrationally-specific kinetic code to study the synergetic effect of successive discharges.

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