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Time-resolved optical spectroscopy of Nanosecond Pulsed Discharges

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A promising way to convert renewable electricity into chemical energy is to use non-thermal plasmas to produce C-neutral fuels from CO_2. Nanosecond repetitively pulsed (NRP) discharges at atmospheric pressure have shown high performances for CO_2 reduction [1,2]. The development of such technology calls for non-invasive, time-resolved diagnostics such as laser-induced fluorescence (LIF) and optical emission spectroscopy to reveal and understand electron and chemical kinetics. In the present contribution, we demonstrate the possibility to estimate the time dependence of the CO_2 dissociation by Collisional Energy Transfer LIF [3-5], a quantitative optical diagnostic method, applicable at high pressure, based on the detailed knowledge of molecular energy-transfer processes [6]. To gain further insights into the physical and chemical mechanisms of CO_2 dissociation, we employed time-resolved optical emission spectroscopy to investigate the discharge progression, from the initial breakdown event to the final post-discharge. Spectroscopic thermometry results, electron temperature and density estimates will be presented and discussed [7].

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