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Time-resolved in-situ quantum cascade laser absorption spectroscopy in dielectric barrier discharges S. WELZEL, F. BREHMER, Eindhoven University of Technology, Eindhoven, The Netherlands, M.C.M. VAN DE SANDEN, Dutch Institute for Fundamental Energy Research (DIFFER), Nieuwegein, The Netherlands, R. ENGELN, Eindhoven University of Technology, Eindhoven, The Netherlands — Modern mid-infrared laser sources, known as quantum cascade lasers (QCLs), provide a means for highly time-resolved absorption spectroscopy in the molecular "fingerprint" region. Pulsed distributed feedback QCLs are especially suited for diagnostic studies on transient plasmas as the time-resolution can be as good as a few tens of nanoseconds. Dielectric barrier discharges in CO_2 operated in the mid-frequency (kHz) range were studied by means of in-situ QCL absorption spectroscopy in single and multiple-pass configuration. Different synchronisation schemes were applied to achieve phase-resolved measurements during individual AC cycles as well as to monitor molecular absorption signals during pulsed operation. Mixing ratios of CO in its electronic and vibrational ground state were of the order of a few percent and thus confirmed ex-situ studies of the effluent. Interestingly, the concentrations levels were changing only slowly in time, i.e. of the order of the residence time. A direct CO_2-to-CO dissociation through electron impact appears very unlikely under these conditions. The kinetics of low-lying rovibrational states of CO_2 along with the evolution of the CO concentration were measured on a sub-millisecond time-scale to establish the (rotational) gas temperatures.

Stefan Welzel
Eindhoven University of Technology, Eindhoven, The Netherlands

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