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Plasma chemistry in CO_2 dielectric barrier discharges F. BREHMER, S. WELZEL, 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 — Plasma-assisted gas phase conversion in non-thermal environments is increasingly being considered as promising technology for fuel production from CO_2 and hydrogen containing sources. Particularly the rate-limiting activation of CO_2 is suggested to be tackled in plasmas at (sub-)atmospheric pressure conditions without the admixture of carrier gases. Therefore CO_2 dielectric barrier discharges were studied to assess conversion yields and reaction mechanisms. The CO_2 discharges were resonantly excited at around 100 kHz in a flow-tube lab-scale reactor designed to facilitate time-resolved in-situ optical emission and infrared laser absorption spectroscopy. Complementary analysis of the gas phase constituents using ex-situ FT-IR spectroscopy and a thorough electrical characterisation were carried out. The CO conversion yields were typically below 5% and hence in-line with similar studies. The energy efficiency can be uniformly described for different external plasma parameters (e.g. flow rate, power input, excitation frequency) as function of the specific energy input. Special attention was paid to the non-negligible formation of by-products such as O_3 and O_2 which suggests an inefficient recycling of atomic oxygen in secondary CO_2 dissociation reactions.

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