Abstract Submitted
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Transport and chemistry in CO_2 microwave plasma unraveled by *in-situ* laser scattering. ALEX VAN DE STEEG, PEDRO VIEGAS, FLORAN PEETERS, ANA SOVELAS DA SILVA, PAOLA DIOMEDE, RICHARD VAN DE SANDEN, GERARD VAN ROOIJ, DIFFER — Efficient dissociation of CO_2 to CO for fuel and chemicals production is studied in a vortex-stabilized microwave plasma reactor. Unprecedented detail in spatial distributions of temperature, internal energy, and species concentrations is obtained with *in-situ* spontaneous Raman in scans of pressure (˜0.1 bar) and flow (10-20 slm) at 1 kW power. Dissociation fractions were typically lower compared to the chemical equilibrium for the measured core temperatures that ranged from 4500K to 6000K, which suggests particle replacement times as fast as several microseconds in plasma core. Peaking of oxygen molecules upstream from the region of atomic oxygen production indicates a central recirculation zone. Analysis of chemistry rates reveals minimal CO back reactions in the reactor and confirms quenching with CO_2 is the dominant O loss mechanism. Comparison of radial profiles of dissociation with global CO yield demonstrates where flow lines start to connect with the exhaust. These measurements demonstrate the importance of multidimensional transport for optimization of the plasma reactor.

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