Abstract Submitted
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Understanding the vibrational distribution in CO_2 microwave plasma for production of carbon neutral fuels, using time resolved in-situ spectroscopy DIRK VAN DEN BEKEROM, TEOFIL MINEA, NICOLA GATTI, FLORAN PEETERS, ERWIN ZOETHOUT, TINY VERREYCKEN, WALDO BONGERS, RICHARD VAN DE SANDEN, GERARD VAN ROOIJ, FOM Institute DIFFER — A microwave plasma could prove to be a cost effective way of converting CO_2 to CO. The efficiencies of such a reactor have been shown to be very high, up to 90%. It is currently understood that the preferable vibrational excitation by plasma electrons plays a key role in the efficient CO_2 conversion. In the case that Vibrational-Vibrational (VV) relaxation times are much shorter than Vibrational-Translational (VT) relaxation times, molecules are vibrationally excited via intermolecular collisions until the dissociation energy is reached. As the VT-relaxation rate increases with temperature, a low temperature is needed to promote an overpopulation of high vibrational levels. To reduce the temperature, The microwave power was pulsed. Raman-scattering was employed to measure the temperature in the radial center and sides of the plasma, over an axial distance of a few centimeter. The infrared absorption spectrum of the CO_2-plasma is recorded using an in-situ step-scan FTIR spectrometer. The absorption bands of higher vibrational levels are visible lower wavenumbers, down to 2000 cm^{-1}. This enables us to look at the evolution of the densities of the vibrational levels. It was found that the vibrational temperature increased during plasma ON-time.

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