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Evaluating Chemical Kinetic Schemes for a CO2 Microwave Reactor: Using the Afterglow with Forethought FLORAN PEETERS, DIFFER, Eindhoven, the Netherlands, GONALO RAPOSO, Instituto Superior Tcnico, Lisbon, PortugalIn, JUEHAN GAO, ALEX VAN DE STEEG, PEDRO VIEGAS, LUCA VIALETTO, DIFFER, Eindhoven, the Netherlands, ELIZABETH MERCER, University of Antwerp, Belgium, PIETER WILLEM GROEN, TIM RIGHART, BRAM WOLF, WALDO BONGERS, PAOLA DIOMEDE, GERARD VAN ROOIJ, RICHARD VAN DE SANDEN, DIFFER, Eindhoven, the Netherlands — Chemical kinetic modelling is the most important tool in the study of complex molecular plasmas. In plasmas for chemical conversion, ionization degrees are low, and neutral densities and gas temperatures high, making neutral-neutral interactions a leading contributor to the chemistry. At DIFFER, microwave plasma in pure CO_2 is developed for production of carbon-neutral synthetic fuels, but can also find application in in-situ resource utilization in the CO_2-rich Martian atmosphere. Both applications benefit from a thorough understanding of the underlying chemistry. In this contribution, an overview will be given of the most important ground-state chemical reactions in CO2, revealing a considerable uncertainty in reaction rate coefficients. By comparing a 2D-axisymmetric model with measured afterglow emission from our CO2 microwave plasma, we establish effective rate coefficients for the case of highly dissociated CO2 at reduced pressure. Increased certainty in neutral-neutral rate coefficients then allows us to improve models of the plasma itself, where the same reactions predominate and indirectly affect the electron kinetics.

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