Abstract Submitted
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Non-Equilibrium Reaction Kinetics of an Atmospheric Pressure Microwave-Driven Plasma Torch: a Global Model[1] GUY PARSEY, YAMAN GÜÇLÜ, JOHN VERBONCOEUR, ANDREW CHRISTLIEB, Michigan State University — In the context of microwave-coupled plasmas, within atmospheric pressure nozzle geometries, we have developed a kinetic global model (KGM) framework designed for quick exploration of parameter space. Our final goal is understanding key reaction pathways within non-equilibrium plasma assisted combustion (PAC). In combination with a Boltzmann equation solver, kinetic plasma and gas-phase chemistry are solved with iterative feedback to match observed bulk conditions from experiments; using a parameterized non-equilibrium electron energy distribution function (EEDF) to define electron-impact processes. The KGM is first applied to argon and "air" systems as a means of assessing the soundness of made assumptions. The test with "air" greatly increases the complexity by incorporating a plethora of excited states (e.g. translational and vibrational excitations) and providing new reaction pathways. The KGM is then applied to plasma driven combustion mechanisms (e.g. H2 or CH4 with an oxidizer source) which drastically increases the range of reaction time-scales. As the reaction mechanisms become more complex, availability of data will begin to hinder model physicality, requiring analytical and/or empirical treatment of gaps in data to maintain completeness of the reaction mechanisms.

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