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Global Model Framework to Identify Relevant Species and Reactions in Chemically Complicated Plasma Systems[1] JANEZ KREK, YANGYANG FU, DE-QI WEN, JOHN VERBONCOEUR, Michigan State Univ — Plasma chemistry mechanisms in plasma assisted combustion (PAC) systems involve a large number of species in reaction chains. Simulations with spatially dependent system variables, e.g. densities and temperatures, become prohibitively computationally expensive. We present a kinetic global model framework (KGMf), coupled with a Boltzmann equation solver for dynamic evaluation of the electron energy distribution function (EEDF) and the sensitivity analysis, to identify the most important species and reactions. Our model employs spatially-averaged energy and particle balance equations, chemical reactions in bulk plasma, taking into account time-dependent power absorption via Joule heating, energy and particle loss to the wall through an analytic collisional sheath model, to determine the role of each species and reaction on steady-state densities and temperatures. It is important to note that a species may be a critical component of a reaction chain leading to an important product, despite low density due to high creation and conversion rates. This enables determination of key species and reactions that are required in spatially dependent simulations.

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