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1P61 - Effects of non-Maxwellian electron energy distribution function on plasma chemistry in Cl_2 and CF_4

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Control of low-temperature plasmas for materials processing is critical to the quality of the product. Therefore, it is required to further refine and customize reactive fluxes. In this regard, a global model was used to study the electron kinetic effects in Cl_2 and CF_4 plasmas. The model was benchmarked against another global model by using the same set of gas phase and wall surface chemical reactions assuming a Maxwellian electron energy distribution function (EEDF). In this model the reaction rate coefficients are calculated by integrating EEDFs with cross sections; the wall recombination coefficients are approximated using available experimental data. The model was validated by comparison with experimental data for chemical composition and plasma density. We used a bi-Maxwellian EEDF (with the hot and cold electron temperatures) to investigate electron kinetic effects on the chemical composition. As the temperature of hot electrons increases at the given constant power, densities of Cl^+, Cl^- as well as Cl increase gradually in Cl_2 plasmas. By contrast, the chemical component in CF_4 plasmas is affected less by variation of hot electron temperature at given power absorbed in plasma. This is due to the relatively high dissociation energy thresholds. However, chemical composition can be significantly modulated by increasing power. Therefore, discharge power and temperature of hot electrons should be used simultaneously to control the densities of chemical species.

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