Abstract Submitted
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Homogeneous and Heterogeneous Reaction Mechanisms in CH_3F-O_2 Inductively Coupled Plasmas[1] VINCENT M. DONNELLY, ERDINC KARAKAS, SANBIR KALER, QIAOWEI LOU, DEMETRE J. ECONOMOU, University of Houston — CH_3F/O_2 containing plasmas are used in selective Si_3N_4 etching over Si or SiO_2. Fundamental plasma studies in these gas mixtures are scarce. In this work, optical emission rare gas actinometry and a global chemistry model were employed to study inductively couple plasmas in CH_3F/O_2 gas mixtures. For constant CH_3F and O_2 flow rates, the absolute H, F and O atom densities increased linearly with power. The feedstock gas was highly dissociated and most of the fluorine and oxygen was contained in reaction products HF, CO, CO_2, H_2O and OH. Measured number densities as a function of O_2 addition to CH_3F/O_2 changed abruptly for H, O, and particularly F atoms (factor of 4) at 48% O_2 A corresponding transition was also observed in electron density, electron temperature and gas temperature, as well as in C, CF and CH optical emission. These abrupt transitions were attributed to the reactor wall reactivity, changing from a polymer-coated surface to a polymer-free surface, and vice-versa, as the O_2 content in the feed gas crossed 48%. Homogeneous chemistry dominates above 48% O_2; a kinetic model with no adjustable parameters is in excellent agreement with the absolute F and H and relative HF number density dependence on power and pressure.

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