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Radical kinetics in low-pressure fluorocarbon plasmas: Experiments and modeling

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The understanding of the complex chemical processes in plasmas requires advanced experimental and supportive modeling techniques. In the particular case of fluorocarbon plasmas, CF- and CF_2-molecules are produced in high amounts so that they are quantitatively measurable with laser-induced fluorescence (LIF). In addition, etching and/or oligomerizing species are generated. In general, the absolute densities as well as the density profiles in the volume are strongly related to the fluorine-to-carbon ratio and to the wall processes [1,2]. Especially the locally resolved CF_2 profiles show high anisotropies in relation to the loss- or the production-rates at the walls.
In this contribution, we present LIF and modeling results on plasmas containing CHF_3 or CF_4 with admixtures of H_2 or O_2. In such a way, a variety of fluorine-to-carbon ratios is realized. The plasma model includes gas-phase processes induced by fragmentation of molecules due to electron impact. It further includes additional sinks and/or sources of molecules at the walls. The model predictions are compared to the results of the experiments. The findings of this work are compared to data from literature, e.g. [3] (experimental) and also to modeling results in [4]. Despite of different experimental setups and modeling techniques, an overall good agreement in the conclusions could be obtained.
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Keywords
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