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Plasma surface interactions in fluorocarbon systems

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Fluorocarbon plasmas have been used for close to four decades in the semiconductor industry. Because such process systems are complex, many individuals subdivided the complete system into three main subsystems, gas-phase chemistry, plasma physics and surface chemistry/physics. Using this methodology, considerable knowledge has been gained in fundamental processes found in the gas-phase chemistry and plasma physics. Despite numerous high quality studies, understanding the surface subsystem has proven to be challenging. In part this is due to the interactions of the three subsystems. In this paper we will review a model of surface interactions for fluorocarbon plasmas which is based on surface-averaged quantum mechanical processes. Using the model we arrive at a general model describing both etch and deposition. We will show how energy considerations, such a local surface temperature, can play major roles in such processes. We will examine the basic links between the model and experimental data obtained from fluorocarbon plasmas.