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Comparison of CF_4, CHF_3 and CH_2F_2 plasmas used for wafer processing STEFAN TINCK, University of Antwerp, ALEXEY MILENIN, imec Belgium, ANNEMIE BOGAERTS, University of Antwerp, UNIVERSITY OF ANTWERP COLLABORATION, IMEC BELGIUM COLLABORATION —
Fluorocarbon-based plasmas are widely used in the microelectronics industry for the fabrication of computer chips, i.e. in plasma etching of silicon. One such process is the etching of nanoscale trenches in the Si substrate with CH_xF_y plasmas as applied in shallow trench isolation (STI). By carefully altering the ratio between gases such as CF_4, CHF_3 and CH_2F_2, the overall etching process can be controlled in terms of chemical etching, sputtering and sidewall passivation. Therefore, we wish to obtain a more fundamental understanding of these plasmas and their surface processes. The plasma behavior will be simulated by a hybrid model for addressing the various plasma species, while the surface interactions of the plasma will be described by additional Monte Carlo simulations, allowing a detailed insight in the nanoscale trench etching process. Bulk plasma properties such as species densities, temperatures and fluxes towards the walls will be discussed under typical wafer processing conditions as well as surface properties including etch rate and chemical composition of the surface during trench etching. The etch rate and microscopic etch profiles will be compared with experimental data.

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