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Absorption spectroscopy diagnostics of a dual-frequency capacitive dielectric etch tool using Ultraviolet Light-Emitting Diodes[1]
JEAN-PAUL BOOTH, LPP, CNRS/Ecole Polytechnique, France, JEROME BREDIN, LPP — Dual-frequency capacitively-coupled etch reactors using Ar/fluorocarbon/O2 mixtures are widely employed for etching of dielectric films for integrated circuit manufacture. CF2 radicals play an important role in the gas-phase and surface chemistry controlling etching and polymer deposition, and their density can be measured by UV absorption via the A-X band (230-270 nm). Previously Xe arc lamps have been used as the light source, but they are rather unstable, limiting the sensitivity of the technique, as well as being cumbersome and relatively expensive. We have successfully replaced the Xe arc with UV light-emitting diodes. The CF2 density was determined as a function of gas composition and power in a modified 2 + 27MHz commercial etch reactor operating in Ar/C4F8/O2. The CF2 density decreases rapidly as the O2/C4F8 ratio is increased, and increases with RF power at both frequencies, but is most affected by 27 MHz power. There is speculation that CF2 may play an important role in the creation and destruction of F-negative ions. However, we did not find any simple correlation between CF2 density and electro-negativity.

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Jean-Paul Booth
LPP, CNRS/Ecole Polytechnique, France

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