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Plasma Characterization of Electronegatively diluted VHF CCP Plasmas ALEX PATERSON, NED HAMMOND, SHAHID RAUF, Applied Materials, ED BARNAT, PAUL MILLER, GREG HEBNER, Sandia National Laboratories — In this study, the plasma characteristics of a VHF capacitively-coupled, 300 mm processing system were investigated. Spatially dependent ion and electron density, as well as electron energy distribution functions, were measured for frequencies between 27 and 170 MHz and for gas mixtures containing argon, SF₆ and CF₄. In argon plasmas, increasing the frequency above 120 MHz changed the ion and electron density spatial distributions from uniform to center high, producing a convex structure. This suggests that electromagnetic effects become important for this particular chamber geometry as the excitation frequency increases above 120 MHz. However, the addition of electronegative gas reduced the spatial non-uniformities, even at the highest frequencies investigated. For instance, diluting argon with SF₆ resulted in the ion and electron density spatial uniformity changing from convex to uniform to concave. Similar effects were also observed with CF₄ addition, but more dilution was required since it is less electronegative than SF₆. This suggests the increasing negative ion density causes the electron density to reduce below a critical value, which results in the standing wave being “damped,” probably due to the increase in the plasma resistance.

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