Characterization of microwave plasmas for deposition of polyparylene

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Polyparylene, a noncritical, nontoxic layer material well suited for long-term applications in the human body, has been deposited by plasma-enhanced chemical vapor deposition of the monomeric species. For that end, a microwave discharge in a pulsed mode has been applied. Important plasma parameters have been evaluated by simultaneous application of Langmuir probe and trace rare gas optical emission spectroscopy. Plasma densities and electron temperature have been found to cover values from an almost Langmuir plasma up to some $10^{10}/\mathrm{cm}^3$ and between 1 and 3.5 eV, respectively. The differences in electron temperature between the two methods clearly show the efficiency of microwave fields to excite the high-energy tail of the electron energy distribution function. Due to diffusion loss, the plasma is spatially inhomogenous which has been taken care of by measuring at four different radial positions and different pressures with the Langmuir probe. This holds true for both ambients: argon and parylene-C. However, the plasma density in parylene is lower by a factor of almost 10, indicating that this molecule and/or its fragments exhibit a strong power for electronic attachment or that the process of ionization must compete with other, parasitic reaction paths. [DOI: 10.1116/1.3148825]