PO4082

Space-resolved analysis of hollow cathode discharges in blind holes

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The hollow cathode discharge can be used for deposition of amorphous hydrogenated carbon films in blind holes with an aspect ratio >>1. The high plasma density of the hollow cathode discharge leads to very high deposition rates up to 600 µm/h. The film homogeneity, i.e. film thickness or structure of these films, vary strongly due to the occurrence of different plasma states inside the blind hole, each of them resulting in very different growth conditions.
For the investigation of these plasma states and the understanding of the influences of the hollow cathode effect on the growth mechanism of thin films a space-resolved optical emission spectroscopy has been performed to determine the plasma species of an argon hollow cathode discharge. A hollow cathode discharge and a glow discharge inside the blind hole have been examined to devise the space-resolved differences of the plasma composition. Furthermore, the etching rates on a silicon substrate has been measured to estimate the ion energy in the collisional plasma sheath. Both results are discussed in the context of the different plasma states and Monte Carlo plasma simulation.

Keywords
hollow cathode discharge
optical emission spectroscopy
hollow cathode effect