Characterization and Applications of High Density Oxygen Plasma Downstream.

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Afterglow properties of radio frequency (rf) glow and high density plasmoidal discharges were investigated, At 60 cm from the plasma exit the high density plasma downstream is mainly consisted of $O(^1D)$ state. At 1000 W rf power it is about 95 % and this fraction slightly decreases with the increase of rf power up to 2500 W because of the production of O^+ ions. 200 W glow discharge plasma yields a lower atom concentration at the same distance compared to the 800 W case and consisted of 55 % $O(^1D)$ atoms.

The calculated wall recombination coefficient (γ) was found to vary from 1.1×10^{-4} to 6.1×10^{-5} having a minimum of 5.1×10^{-5}. The decrease of γ was found to be responsible for the increase of $O(^1D)$ density in the downstream. Existence of ionic atomic oxygen may contribute to the slight rise of γ. The downstream gas temperature is seen to increase with power but shows a drastic drop at about 800 W. This temperature drop is assumed due to the energy dissipation of atoms after leaving the plasmoidal region. Next , a new technique for the measurements of γ of solid materials was developed and demonstrated with oxygen plasma. Finally, it was observed that for gas phase and solid state reactions plasmoidal downstreams are superior over the glow discharge plasma downstreams.