Absolute atomic oxygen density measurements inside the core and effluent of a micro scaled atmospheric pressure plasma jet

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The coplanar micro atmospheric pressure plasma jet (μ-APPJ) is a capacitively coupled radio frequency discharge (13.56 MHz, ~15 W rf-power) designed for optimized optical diagnostic access. It is operated in a homogeneous glow mode with a noble gas flow containing a small admixture of molecular oxygen. This device matches typical dimensions of other microplasma jets. The coplanar geometry simplifies modeling and an electrode width of 1 mm provide a discharge profile of 1 mm² for localized surface treatment at a low gas consumption.

We report on spatially resolved atomic oxygen density measurements from the discharge core to the effluent of the μ-APPJ [1, 2], being in good agreement with recent simulation data [3].

Ground state atomic oxygen densities in the effluent in the order $10^{14}$ cm$^{-3}$ are measured by xenon calibrated two-photon absorption laser-induced fluorescence spectroscopy (TALIF) providing space resolved density maps. The influence of gas mixture and rf sender power on the atomic oxygen densities in the effluent is studied. In the discharge core ground state atomic oxygen densities of several $10^{16}$ cm$^{-3}$ are measured. Special emphasis is set on the decay behaviour in the transition region from core plasma to effluent and it's dependence on the operational parameters. While e.g. the gas temperature in the effluent can be examined by thermocouples, for the plasma core optical methods are used.

Reference

