OPTICAL EMISSION STUDY OF A DIRECTCURRENT, ATMOSPHERIC-PRESSURE NONTHERMAL PLASMA MICROJET*

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Over the past few years, various atmospheric-pressure plasma jets were developed, most of which operate at radio frequency or pulsed DC power with inert gases such as He as the working gas of choice. This work aims to study a direct current driven, atmospheric-pressure non-thermal plasma microjet (PMJ) operated in air and in water with a compressed He/O_2 mixture as the working gas. With a typical current of 15-30 mA and a gas flow rate of 3-5 slm, the PMJ is considerably shorter in length (~1 cm) and weaker in visual appearance than other He plasma jets reported in the literature. Optical emission spectra were taken end-on and side-on (at different distances from the exit nozzle). Preliminary data from end-on spectra show major He emission lines at 492.2 nm, 501.6 nm, 587.6 nm, 667.8 nm, 706.6 nm, and 728.1 nm. Atomic oxygen emissions at 615.8 nm and 777.2 nm were also observed. Similar emissions were observed when the He/O_2 PMJ was submerged in water. The strong emission of oxygen at 777.2 nm can result from direct He* penning ionization of O_2 molecules followed by the electron-impact dissociation of O_2+. The relative intensity of the oxygen 777.2 nm line was found to increase with the increase of the operating current and peaked at an O_2 volume concentration of 0.5%. Spatially resolved side-on OES studies are underway to assess the reactive species at different distances from the exit nozzle of the PMJ device. Detailed results will be presented at the Conference.

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