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# The effect of applied voltage on the laminar-turbulent transition in atmospheric-pressure plasma jet

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Atmospheric-pressure argon cold plasma jet was used to study the effect of applied voltage on the laminar to turbulent transition. The plasma jet consists of a quartz tube of inner and outer diameters of 2 mm and 6 mm, respectively. Two identical copper-sheets of 7 mm width are warped around the quartz tube. The sheets are separated by 35 mm and the upper sheet is connected to an AC high-voltage power supply and the lower one is grounded. The current-voltage waveforms show that the jet has four modes of operations depending on the number of current pulses per each half a cycle of the applied voltage and the generation of the upstream and downstream jets. Also, the generated modes depend on the applied voltage and the discharge frequency. It was found that the transition from laminate to turbulent flow mode shows a shift towered lower flow rate values with increasing the applied voltage. The transition point shifts from 3.75 to 2.6 SLPM as the applied voltage is increased from 14 kV to 25 kV. It is assumed that this shift is due to the increment in the plasma gas temperature with increasing the applied voltage. Moreover, the gas temperature, measured at 2 mm below the tube nozzle, increases from 310 to 355 K as the applied voltage increased from 14 kV to 25 kV. Consequently, this increment in gas temperature increases the dynamic viscosity and decreases the gas density. Therefore, the measured Reynolds decreases with increasing the applied voltage [1].

References

[1] Song J, Tang J, Huo Y, Wei L, Wang Y and Yu D. Effect of dielectric wall temperature on plasma plume in an argon atmospheric pressure discharge. Phys. Plasmas 21, 100704 (2014).

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