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Discharge properties of microsecond pulse driven Argon plasma jet arrays

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Atmospheric pressure plasma jets (APPJs) have attracted much attention due to their flexibility, low cost and ability to treat remote objects. By grouping individual jets together to form jet arrays is a good solution for large area treatment. Most of the reports generated plasma jet arrays using He as discharge gas. However, Ar is more economic than He. But, due to its high breakdown voltage and easy glow to arc transition, little research have been done by using Ar as feeding gas.
In this paper, the discharge properties of Ar plasma jet arrays (with six individual jets) driven by an in-house developed microsecond pulse generator is studied. The single plasma jet is composed with a needle-ring electrodes structure. The discharge properties of plasma jet arrays are studied by short exposure time pictures, current and voltage measurements, optical emission spectroscopy, ICCD camera and schlieren flow visualization. The influence of gas flow rate, pulse repetition frequency (PRF) and discharge gaps on the plasma jet arrays discharge uniformity is observed. The results show that the discharge starts from the outside of the plasma jets, followed by plasma jets in-between. The uniformity, bullet speed and reactive species intensities (OH, N2, Ar) of plasma jet arrays increases with the increase of gas flow rate and PRF. The best uniformity is achieved under a discharge gap between 10 mm- 12.5 mm. The bullet speeds of each plasma jets get the closest value under a gas flow rate of 6 L/min. This study provides useful information for design of homogenous plasma jet arrays for various potential applications.

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