An Atmospheric Pressure Plasma Brush

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Plasma jet devices generate plasmas in an open space (surrounding air) rather than in lieu of confined discharge gaps. Hence, they can be used for direct treatment and there is also no limitation on the size of the object. However, to the best of our knowledge, the dimensions of plasma jet nozzles that have been reported in the literature are mainly very small (sub-millimeter to several millimeters) making treatment of a large area difficult, only few large plasma jets are developed. One way to overcome this shortcoming is the use of plasma jet arrays. However, since individual plasma plumes generated by these plasma jet arrays are independent and not merged, it is relatively difficult to achieve uniform treatment effects.
In this paper, an atmospheric pressure room temperature plasma brush which can deliver uniform surface treatment effects is reported. The plasma structure which includes the negative glow, Faraday dark space, and positive column is clearly visible to the naked eyes. The width of the Faraday dark space diminishes with decreasing gap distance and this phenomenon is different from that observed from low pressure glow discharge plasmas. High-speed photographs taken at an exposure time of 2.5 ns show that the plasma propagates from the nozzle to the object in about 100 ns and 10 ns for gap distances of 6 mm and 2 mm, respectively and the results are consistent with electric measurements. The emission spectra reveal N2(B-A) bands in addition to those of O, N2+, N2 (C-B), and He, indicating that the plasma source is reactive and suitable for applications such as surface modification and materials processing.

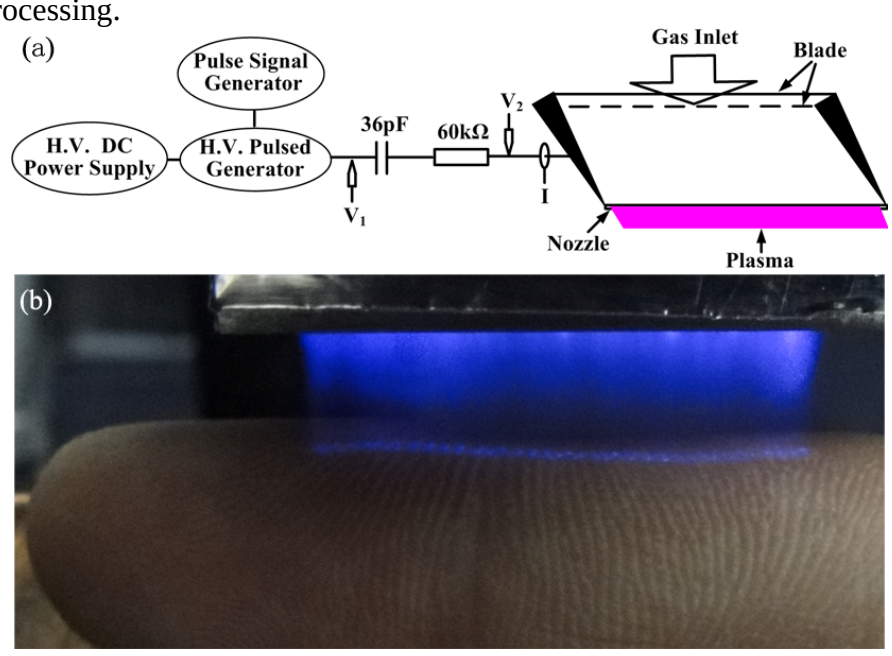

Fig. 1. (a)Schematic of the plasma brush device and (b)Photograph of the plasma brush

Reference

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[2] X. Pei, Z. Wang, Q. Huang, S. Wu, and X. Lu, IEEE Trans. Plasma. Sci. 39 (2011) 2276.