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3P01 - Novel High Voltage Pulsing to Generate Uniform Glow Discharge Air Plasma for Environment Friendly Inline Treatment of Textile

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The OAUGDP is widely explored by researchers for studying surface treatment of materials using helium and argon plasma. However, generation of OAUGDP especially in the air could have great potential in industries because air is freely available in nature. The challenge is to avoid localized high energy streamer formation in the air because of very high voltage rating of power supply in case of the air plasma generation. However, the high power filament generation persists because the controlling the plasma discharge in the glow discharge region in atmospheric pressure air is not yet possible through the feedback control. Therefore, the abrupt transition from dark discharge to abnormal glow filamentary discharge takes place which tends to breakdown the dielectric material and put constraints to use the plasma for inline treatment in the industries.

In this paper, the energy control to the DBD (Dielectric Barrier Discharge) air plasma is proposed which ensure the uniform glow discharge plasma in the air gap. This energy control requires a unique high voltage switching which generates bundles of RF (Radio Frequency) discharge of 0.5 MHz to 2.5 MHz at 6kV but damped oscillations in nature. This damping period ranges from 8 μ s to 10 μ s in repetitive mode. The repetition of switching is limited to maximum 100 kHz to avoid appending of energy in the air gap of DBD to prevent filament generation. The 6kVrms is a significantly lower voltage than the voltage ratings of conventional pulsed DC supply used in DBD plasma generation at atmospheric pressure in the research lab. Still, it provides plasma power density of 2W/cm² which is substantially higher for fast treatment of textile materials such as cotton, polyethene, polypropylene etc. The functionality measurements results for various materials and the diagnostics of the air DBD plasma are also presented in the paper.

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