DEVELOPMENT OF AN ENERGY CONTROLLED DC PULSE DISCHARGE FOR ATMOSPHERIC PRESSURE PLASMA APPLICATIONS

Chang-Seung Ha, Dong-Hyun Kim, Hae June Lee, and Ho-Jun Lee
Dept. Of Electrical Engineering, Pusan National University, Pusan 609-735, South Korea

An atmospheric pressure plasma jet driven by energy controlled DC pulse has been developed. Unlike the most commonly used dielectric barrier atmospheric discharge sources, the proposed device utilize dielectric-free metal electrode with externally controllable ballast capacitor. Discharge energy per pulse can easily and precisely be controlled by voltage and capacitance of ballast capacitor. It is shown that wide range of plasma, from stable glow mode to near arc state, is obtained by varying the injection energy per pulse. The properties of proposed plasma device such as current-voltage waveforms, optical emission spectra and spatio-temporal evolution of discharge were investigated as a function of injection energy, feed gas (Ar or He), and electrode gap distance (200 μm to 1 mm). As well as pulse mode operation, this device can be driven by sinusoidal voltage waveform, the difference between DC pulse mode and AC sinusoidal discharge was also investigated in the voltage range of 500 V ~ 1 kV. The experimental results demonstrate that the proposed plasma device can be used as useful tool for atmospheric plasma applications including bio-medical field.

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