

**ABSTRACT MODEL HTPP11 2010**  
**June 27 - July 3, 2010 • Brussels, Belgium**  
**ABSTRACT DEADLINE : January 31, 2010**

**Submitted to Symposium (Letter) :**  
**Symposium Title :**

Positive- and Negative-pulsed argon plasma plumes in the open air

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Cold atmospheric pressure plasma plumes have obtained great interests for their attractive features and application potentials. In this work, cold argon plasma plumes were generated in the open air by a single medical-needle excited by a high-power pulsed excitation source. Characteristic comparison was carried out in the plasmas under different polarities of applied voltages. The results showed that the positive pulsed plasma plume performed a larger discharge current and stronger optical emission than the negative case. Gas temperature of the plasmas were obtained by the Boltzmann plot method and fitting the synthetic-to-experimental spectrum of the OH (A-X) transition emission bands. It is found that both the positive and negative pulsed plasma plumes are under a relative low gas temperature about 400 K. Through the high-speed imaging, an interesting propagation process was observed for the positive pulsed plasma plume, during which the plasma first propagates in the form of plasma 'bullets', and then transits into typical stream propagation as soon as the 'bullets' disappears in the open air, which is much different with the negative case.

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