Influence of gas flow on plasma length in atmospheric pressure plasma jet

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Recently, plasma techniques under atmospheric pressure circumstances have been adapted for industrial, medical and biological applications. Atmospheric pressure plasmas, such as a plasma jet are typically produced using an arc discharge and a dielectric barrier discharge (DBD). Atmospheric pressure plasma of DBD is intermittently generated using a quartz tube as a dielectric, rare gas and metal electrode by applying radio frequency and high voltage [1]. A plasma jet is released to the atmosphere and is a small bullet-like volume of plasma traveling at unusually high velocities. The length of plasma traveling influences a gas flow [2]. The gas flow is summarized in a laminar, transition and turbulent modes. In this work, we examine the dependence of length of plasma traveling on the gas flow rate. The dependence of plasma length on gas flow rate and the pictures of plasma shape in each mode are shown in Fig. 1. In this configuration, the laminar mode is the region of less than 6 slm and the turbulent mode is the region of more than 10 slm. It is found that the tip of plasma jet in three cases is disturbed. Therefore, the Reynolds number at the tip of plasma jet increases due to the decrease of helium ratio on the cross-section.


Figure 1. Dependence of length on gas flow rate and pictures of plasma shape.