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Operating Regimes of a Plasma Jet under Variable Pressures[1] M. ARDA AKMAN, MOUNIR LAROUSSI, Laser and Plasma Engineering Inst. Old Dominion University — In this paper we investigate the effects of ambient pressure on a plasma jet. This is done by first generating a plasma jet using our tube reactor device which emits a plasma plume in ambient air when high voltage pulses are applied to its two electrodes and a gas such as helium is flown through it. In the experiments reported here the jet is introduced into a Pyrex chamber where the pressure and gas mixture can be controlled. Pressure in the chamber is regulated by controlling the gas flow and the evacuation rate. We discovered that there are four operating phases: First a stagnant phase where the jet length remains virtually constant. This is followed by a second phase where the jet inside the chamber rapidly increases in length (up to 30 cm) as the pressure decreases. Then an operational mode transition suddenly occurs where the plume length decreases dramatically. Further lowering the pressure in this third phase causes plasma to expand in all directions starting from the point where the plume enters the chamber. Below 2 Torr, the entire volume of the chamber gets filled with homogeneous plasma resulting in the fourth phase. These phases were observed by ICCD imaging, electrical characterization and optical emission spectra.

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