Atmospheric pressure low temperature plasma jets were found to consist of ionization waves called “Plasma Bullets” that travel in ambient air at supersonic speeds. [1] Plasma jet’s behavioral changes are known to depend on the background gas pressure the bullets propagate in. [2] Our recent study shows that this dependence is not only related to the background gas pressure but to a physical boundary layer that confines the working gas channel in which the plasma bullets can continue to propagate regardless of the pressure. It is observed that at a constant low pressure inside a vacuum chamber (<100Torr) filled with Helium only, plasma bullet propagation is not present; however inside the connecting tube in which the Helium is flown to the chamber, plasma bullet propagation is visible. The physical boundary created by this tube enables the bullets to propagate while the lack thereof inside the chamber results in diffuse plasma at the same pressure. This boundary does not need to be an object that surrounds the gas flow. This is evident when a Helium gas channel is formed in a chamber with various background gases such as Nitrogen, Argon or air. In this case, at the same pressure as previously, plasma bullets can propagate regardless of the background gas inside the chamber. When only Helium is present and other gasses are evacuated, bullet propagation inside the chamber ceases to exist. Therefore it is believed that in order for plasma bullets to propagate, there needs to be a boundary surrounding the gas channel. In this paper, experimental evidence supporting the observations explained above will be presented.


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