Atmospheric pressure cold plasma jets have been focused on their potential applications to material processing and medical use. For the extensive use of plasma jets, it is essential to generate and transport abundant reactive species. But the amount of additive gas is limited because it easily reduces plasma density and temperature. In this reason, effective gas mixing and injection is necessary. This work aims to point out that selection of gas injection and mixing methods is a critical factor to generate and transport reactive species effectively in a plasma jet.

A helium-oxygen plasma jet source is developed which is composed of a high-voltage capillary electrode inside a quartz tube with outer ring-shape ground electrode. In this type of source, three cases of gas injection mixing methods are compared: 1) central injection of pre-mixed helium and oxygen through capillary electrode, 2) injection of oxygen through capillary electrode with surrounding injection of helium, and 3) injection of helium through capillary electrode with surrounding injection of oxygen. Electrical and optical measurement results reveal that gas injection determines spatial distribution of active species. Comparing to computational fluid dynamics analysis, the difference of reactive species transport is related to spatial mole fraction of species. As a consequence, higher density reactive species density is achieved by central oxygen injection with surrounding helium injection.

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