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Spatial elemental distribution analysis in a atmospheric flame plasma

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Every year many research reports dealing with atmospheric plasma sources appear in the literature due to their many advantages, such as no necessity of expensive vacuum equipment, low cost and simple system, and easy operation. Because of the advantages many types of atmospheric plasma sources have been developed. For example, a microwave and radio frequency(RF) plasma torch, a dielectric barrier discharge (DBD), a corona discharge and flame plasma are well known types of atmospheric plasma sources. From a 3-dimensional large area treatment and environmental standpoint, flame plasma is more suitable than others due to its long plasma extraction length, simplicity to fix on robotic arm and ozone free operation. A flame is a quasineutral flowing plasma that contains positive ions and free electrons; negative ion may also be present if the flame contains a suitable electronegative species. The cations and electrons are formed by chemi-ionization reactions, or by thermal (collisional) ionization reactions. Therefore, it is very important to understand the elemental behaviorsin a flame plasma and a number of articles have been published. On the other hand, the analysis of spatial elemental distribution has not been previously described, and is the focus of this study.

In this work, The spatial distributions of various oxygen and nitrogen elements such as molecule, ion, radical, etc were analyzed using ICCD optical emission spectroscopy (ICCD-OES). Next, the effect of surface modification was investigated using atmospheric flame plasma under mixture gases with LPG and air controlling input power density. The elemental distributions were very dependent on gas mixing ratio and directly influenced on the permanence of the hydrophilic modification that is a result of covalently bound O-H,. C-O and C-Ox(e.g. C=O, O-C=O) groups introduced y flame plasma treatment.