大気圧プラズマジェット特性に及ぼす電源及びアルコール添加の効果

Effect of Power Source and Alcohol Addition on Atmospheric Plasma Jet Properties

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Introduction: Atmospheric pressure plasma jet has been gathering much attention in various field such as environmental and biological field. For industrial application, however, current plasma jet has many drawbacks. Among them, its running cost is not economical and reduction of plasma production cost is still an important issue in the basic discharge research. For example, a small diameter rod electrode helps discharge at low applied voltage with field concentration effect, and reactive radical generation was enhanced. In W.T.Sun's paper[1], the breakdown voltage for argon was reported to reduce by adding ethanol, although detail mechanism is still an open question.

Experiments and results：In this study, alcohol addition effects were investigated with pure argon or argon-ethanol mixture gas in our low frequent (10 kHz) discharge device [2]. Discharge characteristic was modified with small amount of alcohol addition.

So-called plasma flame becomes shorter with alcohol and charged particle (electron) distribution along jet axis is also shorter. Plasma heat flux distribution along jet axis was, however, found to become larger [3]. Electrons are expected to be consumed to decomposed alcohol molecules in Ar gas flow. Some of heat flux seems to be carried by radicals produced in a kind of Penning reaction, since they have internal energy of several eV. Furthermore, the quantitative visualization of reactive oxygen radical in solution irradiated by this plasma jet has been conducted.

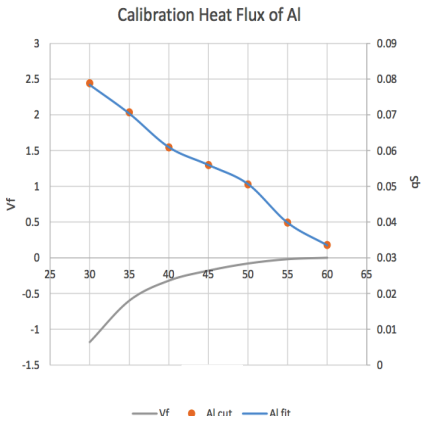

図 1: Measured heat flux and floating potential distribution along jet axis. Electrically insulated Aluminum target with a thermocouple was used and moved along plasma jet axis.

Besides of radical measurement, the electrical characterization of the plasma jet has also been studied by using a high voltage probe (P6015A, Tektronix). The lissajous figures method are adopted for determining the power consumption for plasma production. Necessary electrical power, which is specific to the used power source, is also affected by alcohol addition

Some of these results will be discussed at the conference site. This work was supported by the "ZE research Program, IAE (ZE28B-33/ZE298-19)".

references：[1] W.T.Sun et al.: J. Appl. Phys. 101, 123302(2007). [2] M.Teschke, et al.: IEEE Trans. Plasma Sci. 33, 310(2005). [3] 松浦寛人; 第 65 回応用物理学会春季学術講演会 20p-P4-4(2018).