17p-S10-10

Diagnostics of reactive species on bio-liquid treatment with AC power excited non-equilibrium atmospheric pressure Ar plasma

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1. Introduction

Non-equilibrium atmospheric pressure plasma jet has attracted our attention because it is high density plasma with low temperature. So it has been investigated the potentials in various manufacturing fields. Further, the generation of non-equilibrium plasma jet in atmosphere enables us to perform the direct plasma-treatment of biomaterials. Therefore, our group has focused on the medical and bio applications of non-equilibrium atmospheric pressure plasma and we have successfully realized selective killing of the cancer cells[1] and sterilization of *Penicillium digitatum*[2]. In atmosphere, the entrainment of ambient air affects the generations of reactive oxygen species (ROS) that are crucial factors to determine the characteristics of treatment with the plasma jet. So, in order to clarify the interaction of ROS with bio-liquid surface, quantitative measurement are important. To realize bio-medical application of the plasma source, the mechanisms of ROS generation due to entrainment of ambient air have to be clarified by spatiotemporal plasma diagnostics.

In this study, the spatial distribution of optical emission intensity in the AC excited non-equilibrium atmospheric pressure plasma[3] for bio-liquid treatment was measured by optical emission spectroscopy.

2. Experimental & Results

The non-equilibrium atmospheric pressure plasma was generated between two metal electrode tips, to which a 60 Hz alternating voltage (9.0 $kV_{0\text{-}P}$) was applied. Ar gas was introduced into the discharge region through the gas tube and the flow rate was fixed 2 slm.

The data was recorded by an ICCD camera with the band-pass filter. Figures 1(a)-(b) shows spatial distributions of optical emission intensity due to OH (308 nm) on the condition of 6 and 10 mm distance between plasma head and bio-liquid surface. And Figs. 2(a)-(b) shows spatial distributions of optical emission intensity due to Ar (750.3 nm) on same condition. As shown in Fig. 1, OH emission was observed up to the downstream region by the entrainment of ambient air, while the emission intensity of Ar was very high near the plasma head. In this presentation, I will also report the results to clarify the radical generation and interaction with bio-liquid using laser spectroscopy.

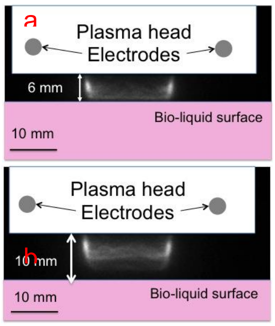

Fig. 1 Spatial distribution of OH emission (@308 nm).

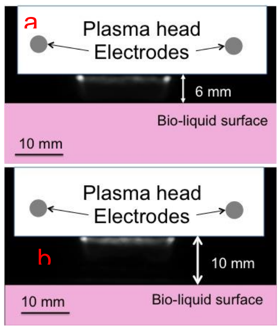

Fig. 2 Spatial distribution of Ar emission (@750.3 nm).

References

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