GEC18-2018-000082

Abstract for an Invited Paper
for the GEC18 Meeting of
the American Physical Society

Studies on selective production of RONS in the plasma-treated water and interaction between the plasma and amino acids

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Atmospheric nonthermal plasma jets have been widely employed in biomedical applications because they induce slight thermal damage to biomaterials. Controlling the production of ROS and RNS in aqueous solutions is important in the plasma-jet system from the viewpoint of application because various cells are activated by ROS and RNS in an aqueous solution. In this study, we show experimental results on complicated interactions of the plasma with the aqueous solutions and the amino acids. First, we show development of a high-frequency plasma jet driven by voltages in the frequency range 6–60 MHz. The high-frequency plasma jet had a high O (^{3}P) atom density of 8 10^{14} cm^{-3}, and considerably contributed to the production of a large amount of RNS in aqueous solutions [1]. Secondly, we show selective production of the ROS and RNS in plasma-treated water [2]. Under the condition of plasma contact to the liquid surface, H_2O_2 was the more dominant species in the water, while for the plasma not contact condition, NO_2^- was the more dominant species in the water. Thirdly, we show the basic study on the interaction between the plasma and amino acids, which is important for biomedical applications of plasmas. Our measurements showed that some amino acids are oxidized or decomposed upon plasma irradiation and that the strong effect of cancer-cell killing is induced by the plasma-treated amino-acid water. [1] G. Uchida, *et al.*, J. Appl. Phys. 122, 033301(2017). [2] G. Uchida, *et al.*, J. Appl. Phys. 120, 203302 (2016).