

Influence of Atmospheric Air Discharge Plasma Irradiation on pH of Water

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Atmospheric discharge plasmas have a potential to provide agricultural productivity improvements and novel medical therapies [2-3]. Plasma treatments on biomaterials have advantages over other methods, because plasma offers high flux of reactive species at low temperature. Interaction between environment and biomaterials takes place mainly at materials surface covered with liquids. Therefore interaction between plasmas and water is an important research topic [1]. Here we study pH of deionized water after dielectric barrier discharge plasma irradiation, because pH can have significant effects on the structure and activity of enzymes, crop productivity, and so on.

2. Experimental

Experiments were carried out using a scalable dielectric barrier discharge (DBD) device. The device consists of 20 electrodes of a stainless rod of 1 mm in outer diameter and 60 mm in length covered with a ceramic tube of 2 mm in outer diameter. The electrodes are arranged parallel with each other at a distance of 0.2 mm. Discharge voltage and Discharge current were measured with a high-voltage probe and a Rogowski coil, respectively. The discharge voltage and the discharge current were 7640-7960 Vpp and 0.2A.

300 μl of DI water was prepared into the quartz 96 microwell plate at 3 mm below electrode. The pH/ion meter Horiba F-72 measured the pH value immediately when plasma irradiation for 10 minutes.

3. Results and discussion

Figure 1 shows pH value after plasma treatment on deionized water as a function of plasma irradiation dose. Atmospheric air plasma irradiation decreases dramatically pH of deionized water with increasing the dose from 3.2 to 7 $\text{J}/(\text{cm}^2 \cdot \mu\text{l})$. We measured concentrations of chemical species such as nitrites, nitrates and H_2O_2 in gas phase and in liquid. We will discuss the chemistries involved at the conference.

Acknowledgements

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References

- 1) T. Shirafuji et al., Jpn. J. Appl. Phys, submitted (2013).
- 2) S. Kitazaki, K. Koga, M. Shiratani, and N. Hayashi, Proceedings of Plasma Conference 2011, pp.23P018-0-1, (2011).
- 3) S. Kitazaki, K. Koga, M. Shiratani, and N. Hayashi, MRS Proceedings vol.1469 (2012).

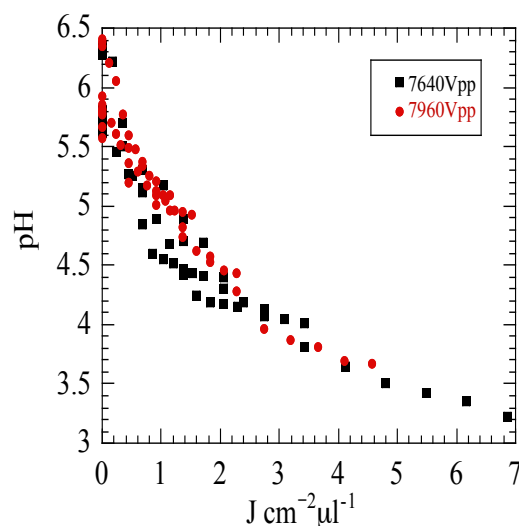


Fig.1 Correlation of pH value and plasma irradiation dose for 10 minutes of plasma treatment on deionized water.