

三次元集積化マイクロソリューションプラズマに対する マイクロバブル援用の効果

The Effect of Micro Bubble Assistance on Three Dimensionally Integrated Micro Solution Plasma

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1. Introduction

Plasma in liquid has attracted much attention because of their possible applications for solving water-related environmental issues. We have previously proposed a novel three-dimensionally integrated micro solution plasma (3D IMSP) reactor, which can generate a large number of microplasmas in a porous dielectric material filled with a gas/liquid mixed medium [1]. However, 3D IMSP is not effective for the treatment of an aqueous solution with a high electrical conductivity [2], which was one of disadvantages of 3D IMSP. In this work, we have introduced micro bubbles into the 3D IMSP reactor in order to treat water with higher electrical conductivity.

2. Experimental procedure

We employed micro-bubble generator (Hack UFB, FB11) as a substitute of the liquid circulation pump used in our previous 3D IMSP reactor [1], in which the circulation speed is faster than in conventional 3D IMSP. The aqueous solutions used for this experiment had electrical conductivities of 1, 10, 100, 200, 500, and 1000 $\mu\text{S}/\text{cm}$, which were prepared by mixing KCl with deionized water and methylene blue.

3. Results and discussion

As shown in Fig. 1, we can confirm that the micro-bubble assisted 3D IMSP reactor can generate plasma in the aqueous solution with electrical conductivity up to 500 $\mu\text{S}/\text{cm}$, while conventional 3D IMSP cannot. Furthermore, micro-bubble assistance has an effect of reducing the ignition and sustain voltages of 3D IMSP as shown in Fig. 2. Although the results are not shown here, we have confirmed that micro-bubble assisted 3D IMSP can decompose

Methylene blue without reducing decomposition efficiency.

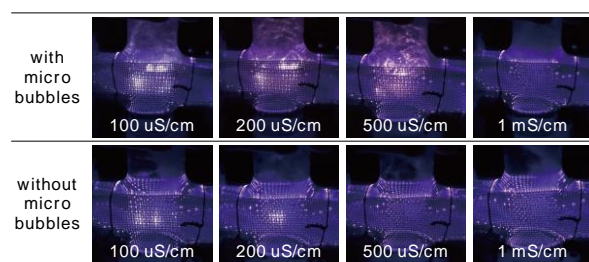


Fig. 1 Effects of micro-bubble assistance on the operation of 3D IMSP.

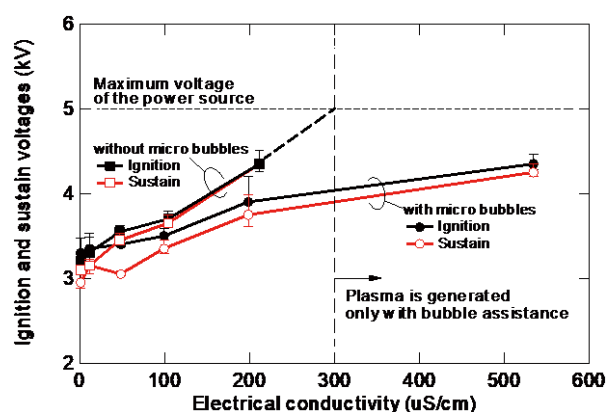


Fig. 2 Effects of micro-bubble assistance on the ignition and sustain voltages of 3D IMSP.

Acknowledgments

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References

- [1] T. Shirafuji and Y. Himeno, *Jpn. J. Appl. Phys.* 52, 11NE03 (2013).
- [2] T. Shirafuji, J. Ueda, A. Nakamura, S.-P. Cho, N. Saito, and O. Takai, *Jpn. J. Appl. Phys.* 52, 126202 (2013).