

# Water treatment using micro-bubble assisted three dimensionally integrated micro solution plasma

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We have performed water treatment for decomposing organic contaminants in water using micro-bubble assisted three-dimensionally integrated micro solution plasma (3D IMSP). The original 3D IMSP reactor without micro-bubble assistance cannot generate plasma when water to be treated has electrical conductivity of 200  $\mu\text{S}/\text{cm}$  or higher. The novel micro-bubble assisted 3D IMSP reactor, on the other hand, can generate plasma in the water with electrical conductivity up to 500  $\mu\text{S}/\text{cm}$ . Ignition and sustain voltages for plasma are also reduced. These results indicate that micro-bubble assistance brings about low-power consumption and extension of application area in water treatment by 3D IMSP.

## 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 amount 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 setup

We employed micro-bubble generator (Hack UFB, FB11) as a substitute of the liquid circulation pump used in our previous 3D IMSP reactor [1]. 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.

## 3. Results and discussion

Figure 1 shows effects of micro-bubble

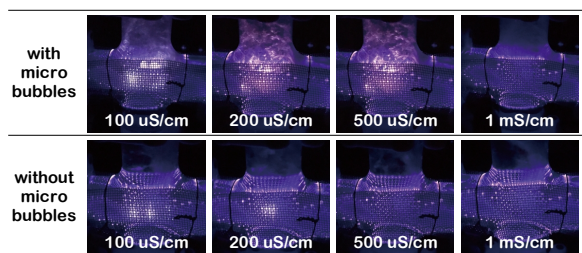


Fig. 1 Effects of micro-bubble assistance on the operation of 3D IMSP.

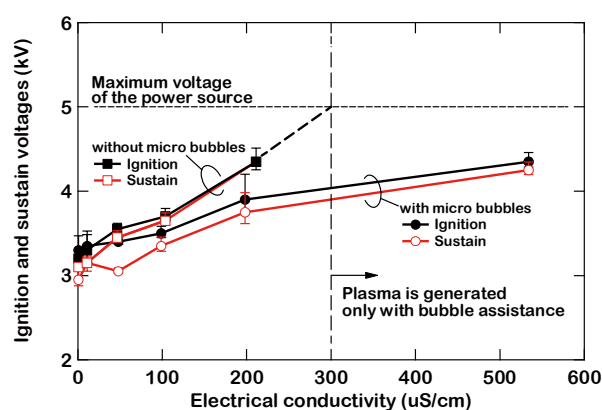


Fig. 2 Effects of micro-bubble assistance on the ignition and sustain voltages of 3D IMSP.

assistance on the operation of 3D IMSP. 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 reactor cannot. Furthermore, micro-bubble assistance has an effect of reducing the ignition and sustain voltages of 3D IMSP as shown in Fig. 2, which means that we can suppress energy consumption for the water treatment by micro-bubble assisted 3D IMSP.

## Acknowledgement

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## References

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