Measuremet of Reactive Species for the Development of Plasma-on-Chip

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Low-temperature atmospheric-pressure plasmas are getting importance in the biomedical field [1]. To understand the interaction between the plasma and cells, we have suggested a brand new device "plasma-on-chip" which enables to culture cells in microwells and to deliver plasma-generated reactive species to the cells through a gas-liquid interface formed at micro through-hole(s) [2]. We have reported the inactivation of *Chlorella* cells using the plasma-on-chip. It should be discussed which plasma-generated reactive species were delivered into the microwells and inactivated the cells. In this study, we demonstrated the delivery of the reactive species through the analysis using in-situ UV absorption spectroscopy [3] and analyzed the concentrations of reactive species.

We prepared a 22-mm-square Si chip (thickness: 200 μm) with 100-μm-square through-holes. The chip was placed on a quartz cuvette filled with deionized water (DI water, around 4.5 mL) as shown in Fig.1(a). Low-temperature atmospheric pressure He plasma jet was used for generating reactive oxygen and nitrogen species (RONS) above the chip and we observed UV absorption below the chip due to the RONS in DI water as shown in Fig.1(b).

The measured spectrum showed a typical UV absorption profile which contained a low concentration of RONS in DI water. After 15 min exposure of the plasma and 15 min stabilization, hydrogen peroxide (272 μg/L), nitrite (59 μg/L) and nitrate (41 μg/L) were detected. We also observed deoxygenation of the DI water due to the He flow onto the water surface through the through-holes. The values were relatively smaller than those of the direct plasma irradiation to the DI water. It is considered that the plasma under direct irradiation conditions was in the humid ambient resulting in much hydrogen peroxide in DI water. This work was supported by JSPS KAKENHI Grant No. 26600130 and Priority Research Grant of KUT.

Reference

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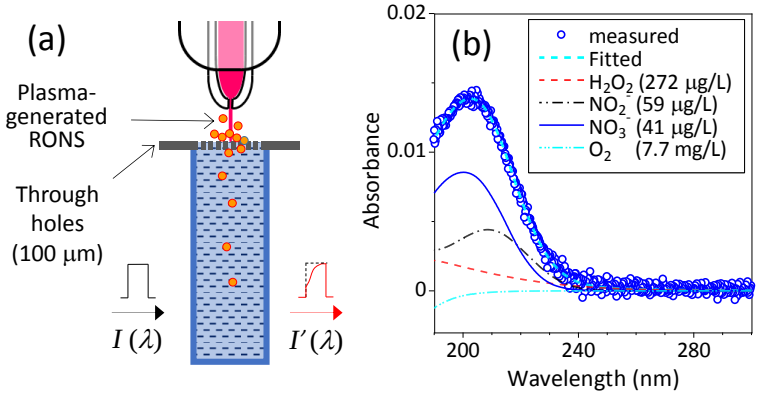

Fig.1 (a) Experimental setup of in-situ UV absorption spectroscopy. (b) UV absorption spectrum.