

Measurement of ion concentration in the solution without reference electrodes using a terahertz chemical microscopy

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1. INTRODUCTION

In recent years, early diagnosis is important to improve quality of our life. To realize the early diagnosis, measurement of ions in bloods with small volumes is one of an excellent option. In our group, a terahertz chemical microscopy (TCM) has been developed to measure ions in the small volume of solutions ^(1, 2). TCM measures the electric potential change of ion selective membranes on a sensing plate. Generally, this kind of ion measurement method using the ion selective membranes requires a reference electrode inserted in the sample solutions, which limit the minimum volume of the sample solutions.

Recently, we proposed to measure “relative” concentrations of ions by fabricating several micro-solution wells on the same sensing plate and comparing the THz amplitude in each well.

In this work, we fabricated several wells to measure standard solutions and the solution with unknown ion concentration.

2. EXPERIMENTAL AND RESULTS

Six wells with a diameter of 1 mm were fabricated on a sensing plate using polydimethylsiloxane (PDMS), and the THz amplitude was measured when the buffer solutions with various pH values were dropped into each well. The surface of the sensing plate was SiO₂ thin film, which could act as an ion selective membrane for protons. The volume of the dropped solution in each well was 500 nL.

Fig.1 shows the distribution of the THz amplitude when the femtosecond laser was irradiated to the sensing plate. The THz amplitude was enhanced at the areas where the solution was on the sensing plate.

We could plot the calibration curve by averaging the THz amplitude in each well and plot them as a function of pH values, which enable us to measure quantitative pH values in solution with unknown ion concentration

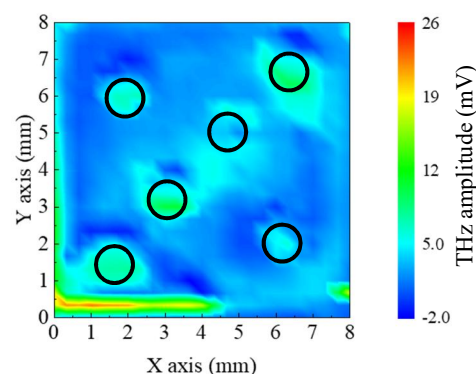


Fig. 1 the distribution of the THz amplitude.

without any reference electrodes.

3. SUMMARY

A terahertz chemical microscopy (TCM) has been proposed and developed for measuring pH and the ion concentration with the multiple and small volume of solutions simultaneously. By fabricating multiple wells on the sensing plate to measure standard solutions, quantitative measurement of ions could be possible without any reference electrodes.

REFERENCES

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