A multi-well structure of light-addressable potentiometric sensor for measurement of a plurality of liquid samples

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Simultaneous measurement of a plurality of analytical samples in a single step is advantageous for reduction of time and cost of laboratory assays. The light-addressable potentiometric sensor (LAPS) [1] offers a platform to integrate a large number of measurement spots on a single sensor plate, which can be accessed by addressing light beams. In this study, we developed a partially-etched structure [2] of LAPS, in which each of the etched region serves as a defined well to accommodate a liquid sample and produces larger photocurrent signals in a wider frequency bandwidth.

Figure 1 illustrates the measurement setup for a plurality of liquid samples on a LAPS sensor plate with a multi-well structure. The structure was fabricated by anisotropic etching of a 200-μm-thick n-type Si (100) substrate with TMAH. As a pH-sensitive surface, a 130-nm-thick SiO_2 layer was formed on the front surface. Thin layers of Ti/Au film were evaporated as ohmic contacts at two edges, where the SiO_2 film was partially removed by 5% HF using a photolithographically patterned resist. Each well could be loaded with 2 - 4 μL of liquid sample contacted with a platinum wire coated with Ag/AgCl. A modulated light beam was used for addressing the wells one by one.

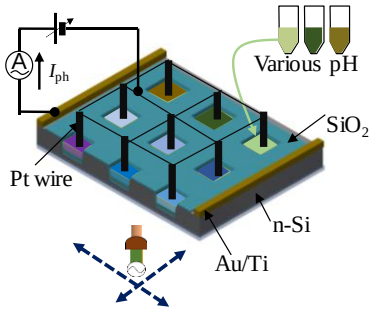

Fig. 1 Schematic of multi-well sensor based on a partially etched structure.

Buffer solutions with pH 1 to 9 were poured into wells 1 to 9, and their potential responses calibrated with their responses to a pH 7 buffer solution were plotted in Figure 2, which showed a pH sensitivity of about 32 mV/pH.

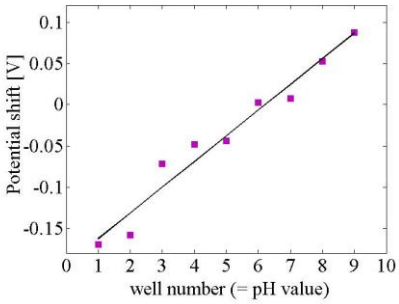

Fig. 2 The bias voltage shift depending the pH value at different wells.

The advantage of the proposed sensor plate in term of its performance and its applicability to biological samples will be discussed in the presentation.

The authors appreciate the financial support of the Japan Science Society and the technical support of the Institute of Nano- and Biotechnologies (INB), Aachen University of Applied Sciences.

[1] D. G. Hafeman, et al., Science 240, pp.1182-1185, 1988.

[2] H. Truong, et al., *EnFI 2017*, Marburg, Germany, 28–29 August, 2017.