A gas-sensitive SPIM for detection ethanol using SnO_2 as sensing element

Department of Electronic Eng. [1] and Department of Biomedical Eng. [2], Tohoku Univ.

○(D) Mengyun Wang[1], Hoang Anh Truong[2], Carl Frederik Werner[1], Koichiro Miyamoto[1], Tatsuo Yoshinobu[1,2]

E-mail: m-wang@ecei.tohoku.ac.jp

Scanning photo-induced impedance microscopy (SPIM) is a method to detect a local impedance change on the sensor surface [1]. In this study, tin dioxide (SnO_2) film is deposited on sensor surface by vacuum evaporation [2] as a sensing material to detect ethanol [3]. The impedance change of the SnO_2 film in response to ethanol is read out in the form of an ac photocurrent signal, generated by a focused laser beam modulated at 3.5 kHz. A schematic of the fabricated structure is shown in Fig. 1a.

The response of the fabricated sensor to ethanol vapor was investigated. Fig. 1b shows the photocurrent-bias voltage characteristics, which were measured before, during and after exposing the sensor to ethanol vapor. As can be seen, the photocurrent at low bias voltages increased in response to the ethanol vapor, which suggests lowering of the impedance of the SnO_2 layer. In addition, a spatially resolved measurement of the gas concentration on the sensor is possible (see Fig. 1c) due to the light-addressability. This gas-sensitive SPIM is expected to have potential applications such as breath analysis, food security, process control and air quality monitoring.

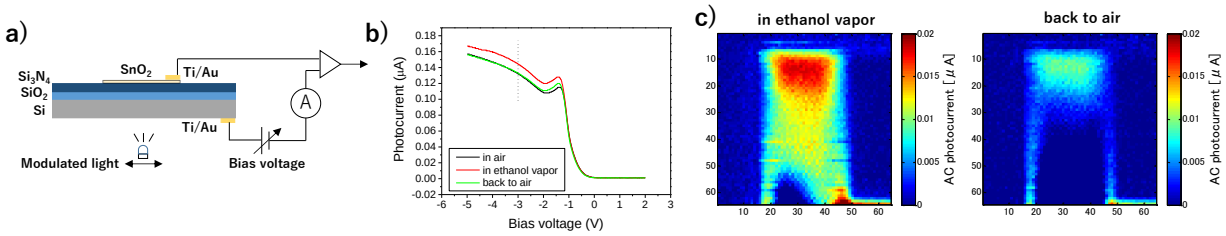

Figure 1. a) Schematic structure of gas-sensitive SPIM; b) I-V curves measured before and after adding ethanol; c) The normalized SPIM images for ethanol and air.

Acknowledgement

The author highly appreciates the financial support by Amano Institute of Technology and Otsuka Toshimi Scholarship Foundation.

Reference

[1] S. Krause, H. Talabani, M. Xu, W. Moritz and J. Griffiths, Electrochim. Acta, 47 (2002) pp.2143-2148.

[2] Donald G.S. Chuah, H.K. Fun, Materials Letters, 4 (1986) pp. 274-278.

[3] M. Wang, L. Zhu, C. Zhang, G. Gai, X. Ji, B. Li, Y. Yao, Sens. Act. B, 224 (2016) pp. 478-484.