Hydrogen gas sensor based on carbon nanotube transistors with palladium source/drain electrodes using the pulse measurement

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Given their superb electrical, mechanical, and chemical properties, carbon nanotube transistors have been extensively explored for a number of electronic device applications. Up to date, highly purified, solution-processed semiconducting carbon nanotube transistors has been shown to be promising candidates for future large-scale macroelectronic applications and they have been also reported for various gas sensors, including a hydrogen gas sensor [1]. However, there have been still severe problems in the way to commercialization of carbon nanotube transistors as gas sensors. In particular, the current drift phenomenon that associated with the hysteresis (change of drain current under a fixed bias as a function of measurement time) has been considered to be one of the critical problems. When low concentration of hydrogen gas is detected using the carbon nanotube transistor, it is difficult to distinguish the correct responses of the hydrogen gas due to the unavoidable current drift in carbon nanotube transistors.

In this work, we propose new measurement method to effectively detect hydrogen gas in carbon nanotube transistors by employing the pulse measurement. It is found that the pulse measurement can provide the current to be saturated within a short time and it enables to successfully detect the hydrogen gas with low concentration from the change of the saturated current.

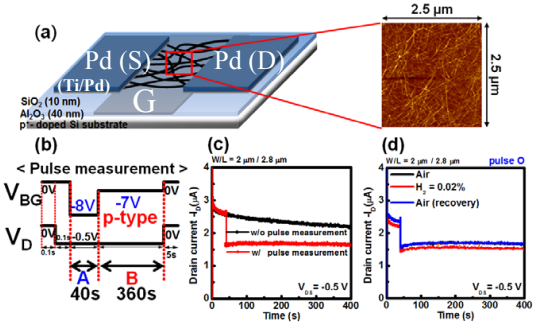

Fig. 1. (a) Schematic of the carbon nanotube transistor as a hydrogen gas sensor. (b) Proposed pulse measurement scheme for reducing current drift phenomenon. (c) Current saturation through the pulse measurment. (d) Hydrogen reaponse using the pulse measurement.

[1] J. Li, Y. Lu, and Q. Ye, M. Cinke, J. Han, M. Meyyappan Nano Lett. 3, 4 (2003)

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