

Humidity-dependent impedance of titanium oxide nanosheets

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Two-dimensional oxide nanosheets have attracted great interest as building blocks for future flexible devices [1]. Chemically exfoliated titanium oxide nanosheets as well as bulk titanium oxides are well known to have super-hydrophilic properties. Impedances of the titanium oxide nanosheets are sensitive to relative humidity, which has been reported in earlier studies [2,3]. In the present study, we try to improve the humidity-dependence for developing highly sensitive humidity sensor.

We deposited titanium oxide nanosheets on SiO₂/Si substrates by using Langmuir-Blodgett (LB) technique and then fabricated comb-type electrodes by electron beam lithography. Figure 1 shows a SEM image of the fabricated device whose electrode gap is smaller than the typical lateral size of the nanosheets.

We measured impedance of the device under various humid conditions. The resistance component of the titanium oxide nanosheets showed a large humidity-dependence as shown in Fig. 2 especially after O₂ plasma treatment for removing surface contaminants such as resist residues.

Figures

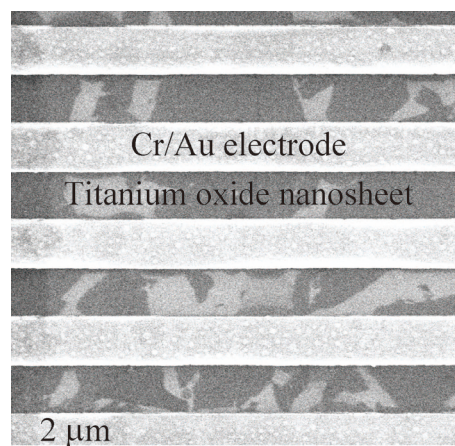


Figure 1: SEM image of titanium oxide nanosheets with comb-type electrodes.

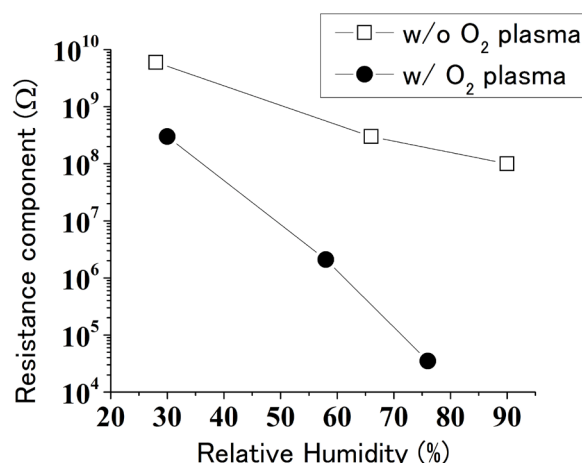


Figure 2: Resistance component of the titanium oxide nanosheets as a function of relative humidity.

References

- [1] M. Osada and T. Sasaki, *Adv. Mater.*, 24 (2012) 210.
- [2] K. Saruwatari et al., *Langmuir*, 22 (2006) 10066.
- [3] A. Tanaka et al., *Appl. Phys. Lett.*, 104 (2014) 163106.