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Extended Abstract

Ternary Carbon-Based Nanocomposite as Sensing Layer for Resistive Humidity Sensor †

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Many principles and methods have been described in literature for measuring relative humidity (RH) and several types of materials have been employed as RH sensing layers [1,2]. This paper reports on the RH sensing response of a resistive sensor employing a sensing layer based on a ternary nanocomposite comprising single wall oxidized carbon nanohorns (SWCNHs)–graphene oxide–polyvinylpyrrolidone, at 1:1:1 w/w/w ratio.

The interdigitated (IDT) sensing structure was manufactured on a Si substrate (470 μm thickness) and covered by a SiO2 layer (1 μm thickness). The metal stripes of the IDT sensing structure were comprised of a Cr (10 nm thickness) and Au (100 nm thickness) stack, having 200 μm width. Six millimeters was the distance between the electrodes. A dispersion formed in water of a nanocomposite comprising oxidized SWCNTs (Figure 1)–graphene oxide–polyvinylpyrrolidone (at 1:1:1 w/w/w ratio) was deposited on the IDT structure using the drop casting method.

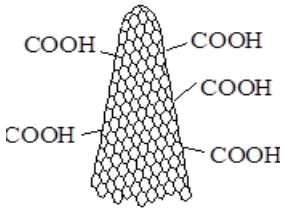

Figure 1. The structure of oxidized single wall oxidized carbon nanohorns (SWCNHs).

The RH detection capability of the structure was investigated by applying a current between two electrodes and measuring the resistance of the IDT, at different RH levels. Since oxidized SWCNTs and graphene oxide are p-type semiconductor materials, the interaction of the sensing layer with water molecules reduces the number of holes in the sensing material, thus increasing the sensor resistance (Figure 2). The performance of the sensor introduced by this paper was compared with

that of a commercially available Sensirion RH sensor, which was placed in the same humid nitrogen environment (Figure 2).

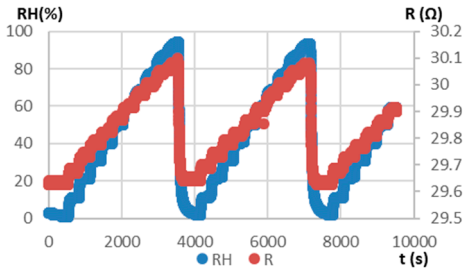

Figure 2. The output of the sensor (**red**), in time; RH variation (**blue curve**), as measured by a commercial, industrial sensor.

The IDT sensing structure introduced by this paper exhibits a linear response and good RH sensitivity when varying RH from 0% up to 90% in humid N2 environment. The sensor response time and stability are comparable to that exhibited by a commercially available Sensirion RH sensor.

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