T10-P: Hydrophilic oxidized carbon nanohorns/PVP/KCl nanohybrid for chemiresistive humidity sensor

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In recent years, oxidized carbon nanohorns (CNHox) and their nanocomposites with different polymers and semiconducting metal oxides were employed as sensing layers in the design of several chemiresistive relative humidity sensing structures [1, 2]. This paper reports on a resistive sensor's RH sensing response, employing a ternary nanohybrid composite as sensing layers, comprising CNHox, PVP (Polyvinylpyrrolidone), and KCl; these were prepared at different w/w/w ratios (7:2:1, 6.5:2:1,5 and 6:2:2), and named K1, K2, and K3 respectively. The sensing structure includes a silicon substrate, a SiO_2 layer, and interdigital transducer (IDT)-like electrodes. The sensing film was deposited via the drop-casting method on the sensing structure. The sensing layers' morphology and composition were investigated through Scanning Electron Microscopy (SEM) and RAMAN spectroscopy. The RH capability of the

manufactured sensors was investigated by applying a constant current between two IDH electrodes and measuring the voltage at different values of RH. Measurements performed showed that the resistance for one of the sensors (K1) has a linear behavior with the variation of the RH (see Fig. 1), except for the first cycle (RH= 0 up 100 down 0). The response to the RH variations in time was determined using a commercially available state-of-the-art capacitive sensor as a reference (see data plotted in Fig. 2). Two types of sensing mechanisms responsible for the measured RH sensing behavior were identified, which can be discussed in terms of the Hard and Soft Acids and Bases (HSAB) theory.

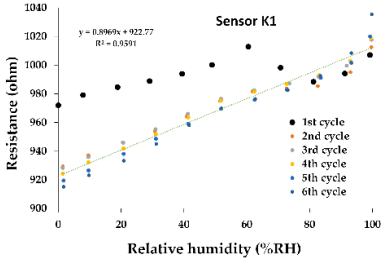

Fig. 1 – RH response of chemirestive sensor K1 employing CNHox/PVP/KCl (7:2:1 w:w:w ratio) as sensing layer

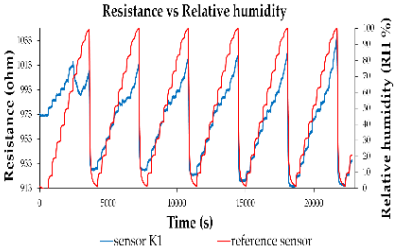

Fig. 2 – Functional response, in time, of the K1 sensor (six complete cycles of RH variation)

[1] B.C. Serban et al., Coating **2021**, 11(5), 530.
[2] B.C. Serban et al., Materials **2022**, 14 (11), 2705.

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