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MATRIX NANOCOMPOSITE FOR RESISTIVE OXYGEN SENSOR

Bogdan Catalin Serban[1], Octavian Buiu[1], Marius Bumbac[2], Cristina Mihaela Nicolescu[3], Mihai Brezeanu[4]

[1] IMT Bucharest, National Institute for Research and Development in Microtechnologies, 126A Erou Iancu Nicolae, 077190 Voluntari, Romania.

[2] Sciences and Advanced Technologies Department, Faculty of Sciences and Arts, Valahia University of Targoviste, 13 Sinaia Alley, 130004 Targoviste, Romania, marius.bumbac@valahia.ro

[3] Institute of Multidisciplinary Research for Science and Technology, University of Targoviste, 13 Sinaia Alley, 130004 Targoviste, Romania.

[4] University Politehnica of Bucharest, Romania, Faculty of Electronics, Telecommunications and IT, 1-3 Iuliu Maniu Blvd., 6th district, 061071, Bucharest, Romania

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Introduction

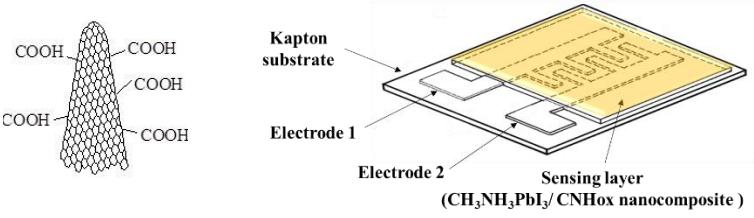
Oxygen concentration monitoring is paramount in various environmental technologies and domestic activity fields, such as indoor air quality control (air conditioning and ventilation systems), combustion optimization in industrial boilers, and pollution control through automobile engine management. Resistive sensors, while known for their low cost and simplicity, are typically not used to directly measure oxygen (O_2) levels in air quality monitoring systems. Oxygen sensors, particularly for quantifying O_2 levels in the air, typically rely on different principles, such as electrochemical sensors or optical sensors.

Resistive oxygen sensors, also known as resistive oxygen probes or resistive oxygen detectors, do indeed offer an alternative to the classical potentiometric oxygen sensors in certain applications, particularly in harsh environments and at high temperatures. They typically use a metal oxide as the sensing material, and the resistance of this material changes in response to the oxygen level in the surrounding environment. This change in resistance can be measured and used to infer the oxygen concentration.

Sensor architecture

This paper reports the development of a new resistive oxygen sensor, employing organic-inorganic halide perovskites such as methylammonium lead halides (CH3NH3PbI3), /oxidized carbon nanohorns (CNHox) nanocomposite as sensing layer. The oxygen sensor includes a Kapton substrate, electrodes, and a sensing layer obtained via spin coating. Electrodes are deposited on the surface of the dielectric substrate by direct printing. They can be linear or have an interdigitated configuration.

The oxygen monitoring capability of the sensing layers was investigated by applying a current between the two electrodes and measuring the voltage at different values of the oxygen concentration to which the sensing layer was exposed. The resistance of the sensitive layer varies with the oxygen concentration.



a) **b)**

Figure 1. a) Structure of oxidized carbon nanohorns, and b) sensing device architecture

Advantages of the proposed sensing layer

The new synthesized sensing layer used in the manufacturing of resistive oxygen sensors has several significant advantages:

- the presence of CNHs-ox ensures a high specific surface area/volume ratio as well as a substantial affinity for oxygen molecules;
- rapid response of the sensor to variations in the value of oxygen concentration
- improving the mechanical properties and processability of the sensitive layer;
- detection over a wide temperature range;
- rapid response of the sensor to variations in the oxygen concentration value;
- reversible.

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