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# Nanocomposite Matrix for Resistive Oxygen Sensor

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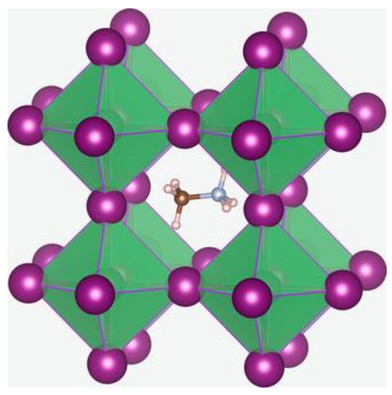
## Scope:

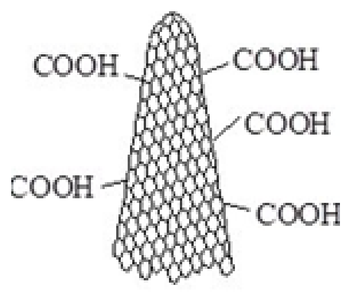
Development of new sensing layers for resistive $O_2$ sensors using nanocomposites of organic - inorganic halide perovskites such as methylammonium lead halides ($CH_3NH_3PbI_3$) and oxidized carbon nanohorns (CNHox).
Oxygen concentration monitoring is paramount in various environmental technologies and domestic activities, such as indoor air quality control (air conditioning and ventilation systems), combustion optimization in industrial boilers, pollution control through automobile engine management, etc.

## Original approach:

- resistive sensors, while known for their low cost and simplicity, as well as their suitability for harsh environments and high temperatures, are typically not used to directly measure O2 levels in air quality monitoring; electrochemical or optical sensors are usually the preferred alternatives for this purpose;
- resistive oxygen sensors, also known as resistive oxygen probes or resistive oxygen detectors, typically use a metal oxide as the sensing material, and the resistance of this material changes in response to the oxygen level in the environment;
- the oxidized carbon nanohorns present in the matrix of the sensing layer offer the affinity for oxygen molecules, together with a high specific surface area/volume ratio.



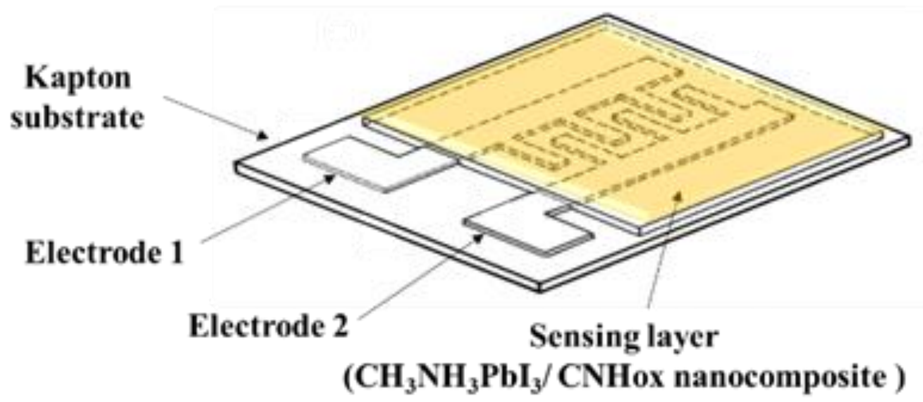
Methylammonium lead halides ($CH_3NH_3PbI_3$)




Oxidized carbon nanohorns (CNHox)

## Sensing device architecture:

- Nanocomposite matrix sensing layer obtained by spin coating on a Kapton substrate
- Electrodes deposited by direct printing on the surface of a dielectric material
- Linear or interdigitated configuration electrodes may be included in the sensing devices




- the oxygen monitoring capability of the sensing layers is investigated by applying a current between the two electrodes, and measuring the voltage while exposing the sensing layer at different values of the oxygen concentration
- resistance of the sensitive layer varies with the oxygen concentration

## Advantages of the new $O_2$-sensing nanocomposite layer:

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

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