RESISTIVE SENSOR FOR RELATIVE HUMIDITY

AGEPI AGENŢIA DE STAT PENTRU PROPRIETATEA INTELECTUALĂ A REPUBLICII MOLDOVA
Expoziţia Internaţională Specializată INFOINVENT
22-24 noiembrie 2023
Ediţia a XVIII-a

ROMANIAN PATENT APPLICATION A/00479, 28.01.2022

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INTRODUCTION

RH sensors have received increasing attention in the last years due to their importance in a large variety of residential, industrial, and commercial applications. One can mention some of those: controlling and sensing humidity in offices and homes, medical field (gas supply infrastructure, incubators, sterilizers), food/beverage processing, chemical industry (dehumidifiers, smelting furnaces, dryers), pharmaceutical processing, electronics (semiconductor fabrication plants, clean room controls) agriculture (drip irrigation), weather station, textile, and paper industry, automotive industry (engine tests beds).

ORIGINAL APPROACH

This patent application refers to the development of resistive relative humidity (RH) sensor, employing a sensing layer based on a binary nanocomposite comprising oxidized carbon nanohorns (CNHox)(Fig.1) –sodium lignosulfonate (Fig.2), oxidized carbon nanoonions (CNOox))(Fig.3) –sodium ligonosulfonate or ternary nanocomposite comprising oxidized carbon nanohorns (CNHox), oxidized carbon nanoonions (CNOox), sodium ligonosulfonate.

The RH sensor includes a Kapton substrate, interdigitated electrodes and a sensing layer obtained via spin coating method. The RH 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 at which the sensing layer was exposed. The resistance of the sensitive layer varies with RH level.

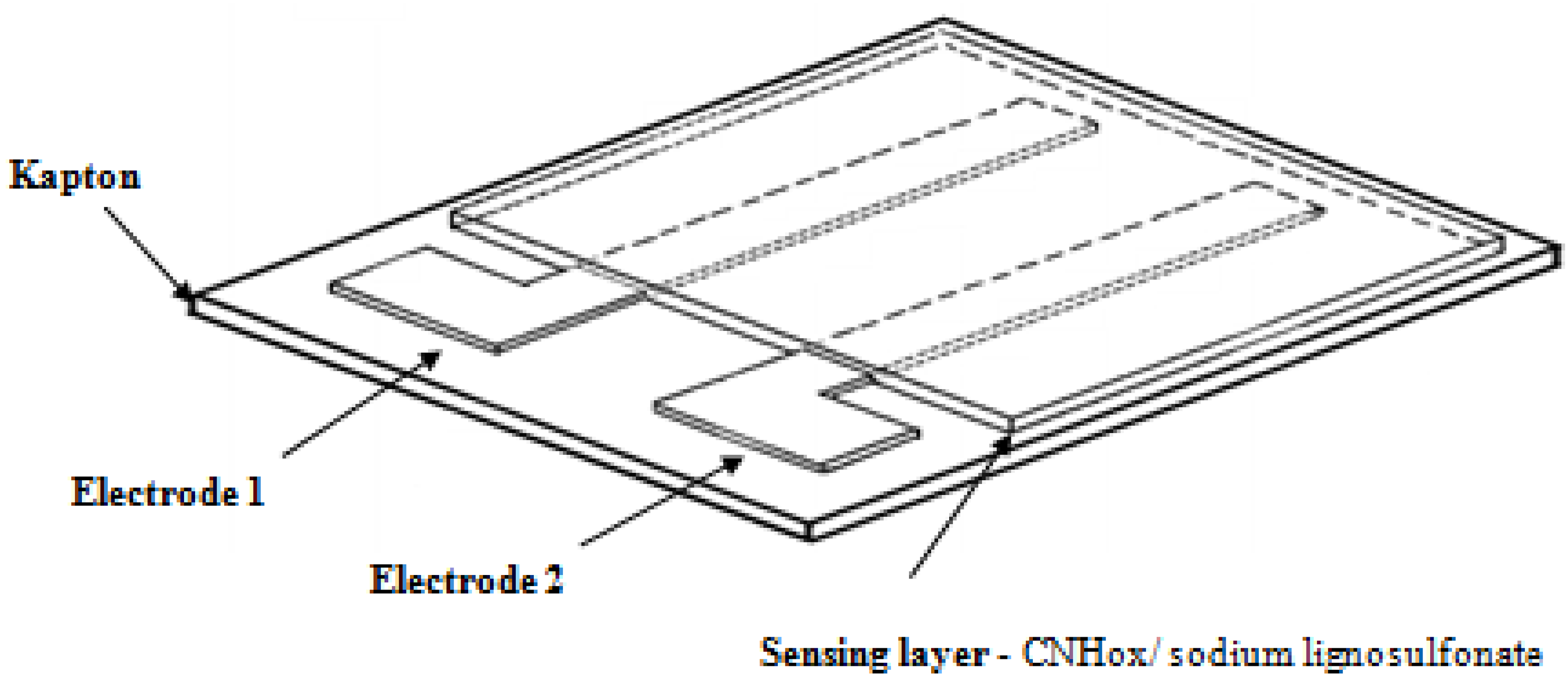

Fig.4 Structure of the sensor

SYNTHESIS OF THE SENSING LAYER

The raw materials required for the synthesis of the sensitive layer are sodium lignosulfonate and oxidized carbon nanohorns.

1) The solution of sodium lignosulfonate in water is prepared by dissolving 15 mg of polymer in 100 mL of deionized water, under magnetic stirring (3h, at room temperature).

2) Then add 85 mg of oxidized carbon nanohorns to the previously prepared solution and continue stirring magnetically for 2 hours at room temperature.

3). The solution obtained is deposited by the "drop casting" method, using a Kapton substrate with linear electrodes or interdigitated electrodes (after previously masking the contact area).

4). The obtained sensitive layer, deposited on the substrate, is dried in an oven at 80 ^{o}C for 60 minutes.

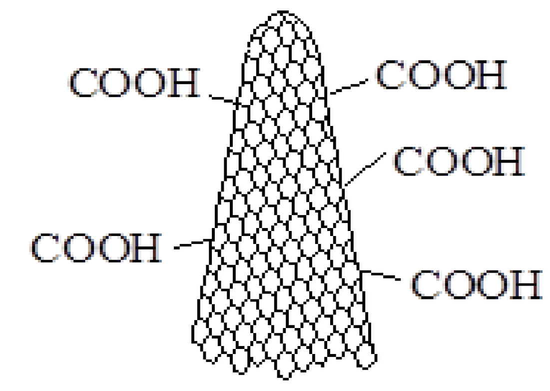

Fig. 1 Structure of oxidized carbon nanohorns (CNH_{OX})

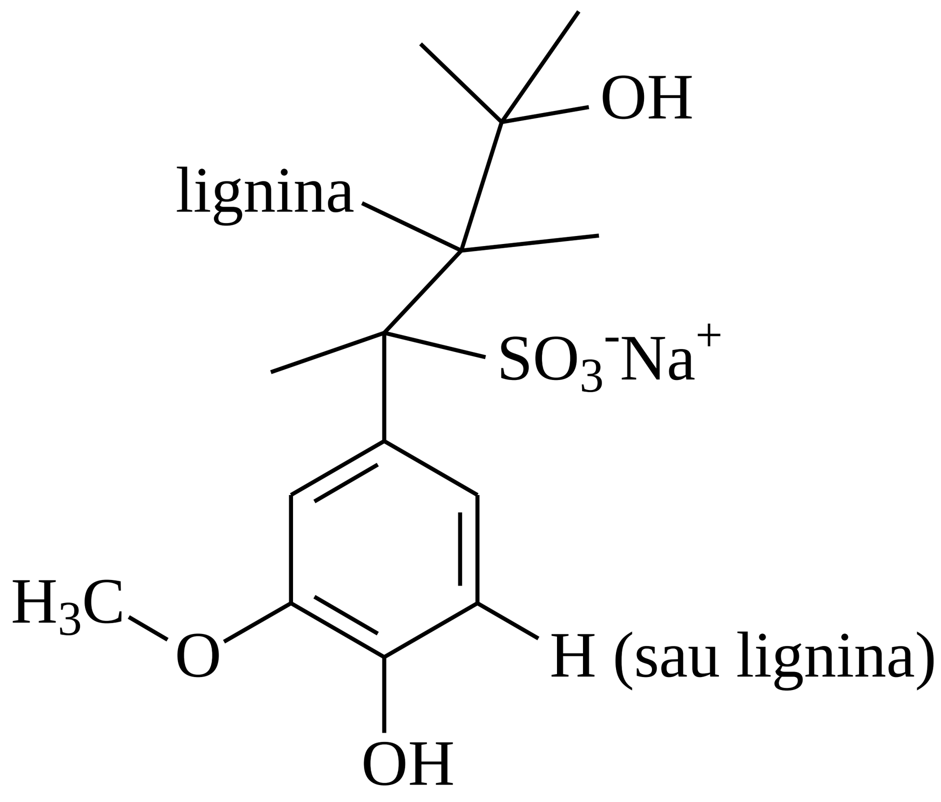

Fig. 2 Sodium lignosulfonate

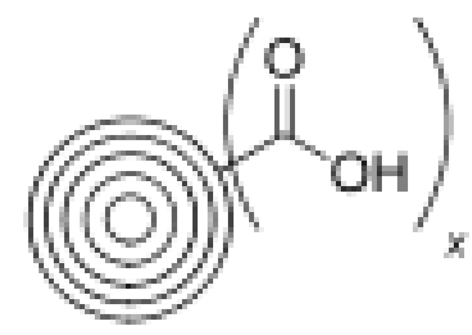

Fig. 3 Structure of oxidized carbon nanoonions

ADVANTAGES OF THE PROPOSED SENSING LAYER

The new synthesized sensing layer used in the manufacturing of resistive RH sensor have several significant advantages:

- the presence of CNHs-ox and CNHox ensures a high specific surface area / volume ratio as well as a substantial affinity for water molecules;
- the dispersing character of sodium lignosulfonate facilitates uniform distribution of the nanocarbonic material within the nanocomposite;
- detection at room temperature;
- rapid response.