

Survey on Life Estimation of Composite Humidity Sensors Using numerous Artificial Intelligence Techniques

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Abstract:

To find and evaluate the ratio of humidity in air a humidity sensor is employed. Environmental pollutants are used to fabricate replacement pollutants are like lampblack and ZnO, and it performs as a humidity sensor. For nature confirmation, characterization is performed. To verify the surface roughness Complex impedance spectroscopy (CIS), infrared spectroscopy (FTIR), X-ray diffraction (XRD) and scanning microscopy (SEM) are used. The lifespan of the fabricated humidity sensor is found by life testing. An intelligent prototype is meant using AI techniques, including the synthetic neural network (ANN), fuzzy inference system (FIS) and adaptive neuro-fuzzy inference system (ANFIS). The range of excellent composite humidity sensors is 30–95%.

Keywords – Infrared spectroscopy, scanning electron microscopy, fuzzy electron system.

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INTRODUCTION

A various studies have been conducted to extract new materials through doping in order to get the best composition. One of the most prominent environmental pollutants is carbon black which is an easily available insulating material produced due to combustion of solid material. It exhibits amorphous properties, and due to this carbon affects conductivity of the composite material in a visible manner. One of important materials to be used in electrochemical capacitors electrodes is zinc oxide. This oxide material has mostly enforced in optoelectronic and electronic equipments, for example devices are light-emitting devices, gas sensors and solar cells, so blended materials

depended on carbon and zinc oxide will become important electrode materials for electrochemical capacitors. As surveyed in previous studies for the making of zinc oxide many methods have already designated. They are, for example: hydrothermal technique, laser ablation. The electro deposition way is found as the important method for the process of producing compound of ZincOxide as it is easy and minimum temperature procedure, maximum amount of deposition t, inexpensive way and appropriateness for huge area substrate. This way uses a minimum potential or current to produce ZincOxide on any conductive substrate. In above deposition method, the thin layer measurements, structures and electrochemical characteristics could

be used by a different of operating parameters: intensity of current , voltage applied, deposition time & the electro deposition . As a pre cursor generally, $ZnCl_2$ solutions or ZnN_3 solutions are used in this deposition .. Overall, the Zn content is 55.38% while the O2 content remains at 44.6%. More recently, materials scientists and engineers have suggested and found different techniques of using this waste product for the synthesis of some useful composites. The three different soft computing methods which are been used for intelligent modeling. The method, that is. accelerated life testing method, is used to compute the lifetime. Different artificial intelligence methods, such as ANN, FIS and ANFIS, have been incorporated through MATLAB Simulink, which constitutes an intelligent model that predicts life of the fabricated sensor

II. COMPOSITE HUMIDITY SENSORS

For the preparation of a sample, zinc has been prepared by means of the Sol-Gel method at the laboratory. For lampblack, fumes are collected during a closed chamber to accumulate on the highest lid through combustion. For the composite electrolyte, ten samples are prepared. Firstly, lampblack and flowers of zinc were kept during a hot-air oven at a temperature of 423 K for activation purpose. This process takes nearly two hours, and then both flowers of zinc and carbon were mixed and grinded continuously for 2 hours, employing a mortar and a pestle

III. CHARACTERIZATION TECHNIQUES

There are various tests which are used to confirm the composite nature like Complex impedance spectroscopy; Fourier transforms infrared spectroscopy, X-ray diffraction and scanning electron microscopy (SEM) for conducting nature.

TABLE-1: Complex impedance spectroscopy

Sr No	Characterization Technique	Description
1	Complex impedance spectroscopy	Accomplishing behavior of carbon

2	Scanning electron microscopy (SEM)	To obtain e images of the material. Which we have used for fabricating
3	X-ray diffraction.	Examined crystalline nature of carbon black and zinc oxide

The conducting behavior of a carbon black and zinc oxide composite is examined using complex impedance spectroscopy. This is used to convert the obtained data into graphical images. The pressure-contacted stainless steel electrodes is used by us in the lab and these two connects with instruments of electro chemical workstation with a frequency range of 0.00001 Hz to 100 kHz .The maximum conductivity was determined amongst the samples depending on resistance value on above basis.

A. Scanning electron microscopy (SEM)

SEM test is employed to urge the surface images of the fabric. This mainly determines surface morphology, orientation also because the surface hardness of the composite material. .Inside the composite SEM has decided the presene of 2 materials at micro-level within the composite. The particle size is 1 which is smallest μm and so the largest is 25 μm . For a SEM micro graph of carbon., Is at

B. X-ray diffraction.

The crystalline nature and homogeneous feature of the blended material ZincOxide and carbon is determined by X-ray diffraction test.

IV. HUMIDITY MEASUREMENT

Life estimation of composite sensor is an important aspect when successful operation is considered.

The artificial intelligence techniques are applied to representl an expert system that predicts the lifespan of the humidity sensor. Artificial Neural Network and fuzzy inference as well as adaptive neuro-fuzzy inference system are different methods used for expert system.

TABLE-2: Artificial neural networks-based intelligent system

Sr No	AI Technique	Description
1	Artificial neural networks-based intelligent system	ANN that alters a group of interpreted variables at their input into other group of numerical.
2	Fuzzy logic intelligent system	It deals linguistic variables and it is comparatively understandable.
3	Adaptive Nuero Fuzzy intelligent system	The properties of Fuzzy inference model and ANN are used. It is not necessary formulate the fuzzy rules.

Artificial neural networks (ANN) performs operations on non-linear operators that changes a group of variables at their input into another set of numerical data at their output. To update the network output on continuos basis this ANN technique uses a mapping technique. In the diagram below we can see that these networks used here 3 inputs and 1 outputs and 10 neurons within the hidden layer. This input variable represent three inputs which show V,temp and humidity, and result is seen by life span system .

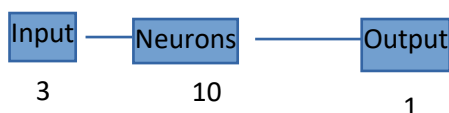


Fig-1 Artificial neural networks-based intelligent system

A. Fuzzy logic intelligent system.

The system which is fuzzy inference has an advantage over ANN. it is comparatively user-understandable. Implementation of fuzzy is done using MAT LAB Simulink. The main benefit of ANFIS is that mixes the properties of fuzzy inference system as well as artificial neural networks. The lifetime data are uploaded into MATLAB Simulink, and then the system is trained and tested. Another advantage of ANFIS is that

there emerges no need to formulate the fuzzy rules as the adaptive system constructs the rules itself, through the learning.

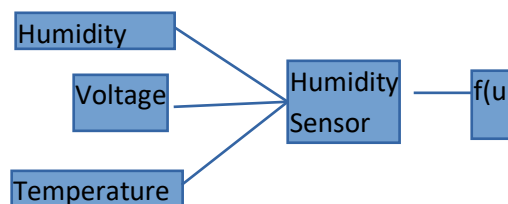


Fig-2 Fuzzy logic-based intelligent system

V. CONCLUSION

A humidity sensor based on zinc oxide and carbon has been constructed and its different ways has been prepared using various tests. Complex impedance spectroscopy shows that electronic conductivity of the sensor. Scanning electron microscopy has confirmed the morphology of the composite. XRD and FTIR have confirmed its nature. The humidity sensor thus fabricated shows good performance having the range of 30% RH to 95% RH. Calculation of lifetime sensor is done using variety of artificial intelligence methods variety of artificial intelligence different ways

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