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EFFECT OF TEMPERATURE ON THE ELECTRICAL CONDUCTIVE PROPERTIES OF POLYANILINE

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Abstract: This in research polyaniline electricity conductivity temperature impact experimental accordingly was studied. Experiments were conducted from −50°C to 300°C. was temperature between take went. Results this showed that the temperature increase with electricity conductivity initially exponential accordingly increases,but above 200°C at temperatures polyaniline to degradation occurs and permeability sharp decreases. At low temperatures and of electrons kinetic of energy decrease as a result conductivity decrease observed.
Research results polyaniline temperature sensors,supercapacitors and energy storage in systems application opportunities to expand help gives.

Keywords: polyaniline, electrical conductivity, temperature, dopants, semiconductor, degradation.

INTRODUCTION

Polyaniline (PANI) - electrical conductivity with separated standing organic polymer mold, electronics, energy storage in systems and sensor technologies wide is used. Its electricity features temperature, dopants, molecular structure and exterior physicochemical to the conditions related. Electricity conductivity in terms of polyaniline metal and semiconductor materials between intermediate position occupies and various physicist effects under noticeable to changes occurs.

This in research polyaniline electricity conductivity temperature impact studied, temperature increase and decrease under the circumstances face giving physicochemical processes analysis Research results polyaniline future electronic devices, sensors and energy storage in systems application opportunities deep to understand help gives.

II. METHODS

1.Material preparation : Polyaniline sample chemical oxidation polymerization method with prepared. Protonation process for sulfuric (H_2SO_4) and phosphoric (H_3PO_4) acids as dopants used. Dopants type polyaniline electricity conductivity noticeable impact showed.

2. Electrical conductivity Dimensions : Polyaniline electricity conductivity from −50°C to

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300°C was temperature between. The measurements were made using direct and alternating current methods.

The electrical resistance **(R)** was determined and the electrical conductivity was calculated using the following formula: $\sigma = 1/R$

Temperature (°C)	Electrical conductivity (S/cm)
-50	0.002
0	0.01
50	0.05
100	0.2
150	0.8
200	1.5
250	0.7
300	0.1

3. Thermal and structural analysis

- The temperature-dependent degradation process was studied using **differential thermal analysis (DTA) and thermogravimetric analysis (TGA).**
- The degree of crystallinity and changes in the bond structure of polyaniline were monitored by **X-ray diffraction (XRD) and Fourier-transform infrared spectroscopy (FTIR) methods.**

III. RESULTS

1. Increase in electrical conductivity with increasing temperature. In the range of 50-150°C, the electrical conductivity of polyaniline increased exponentially. This is due to the increase in electron mobility and the activation of dopants, and is described by the Arrhenius equation:

$$\sigma = \sigma_0 e^{-Ea/kT}$$

Here *Yes* - activation energy,k – Boltzmann is a constant and T is the temperature.

2. Excessive at temperature degradation: above 200-300°C at temperature polyaniline structure broken,electric conductivity sharp decreased. Thermal analysis results polymer initial

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temperature at 250°C to degradation meet showed.

3. At low temperatures electricity conductivity decrease: at temperatures below −50°C electricity conductivity noticeable at the level decrease observed. These electrons kinetic of energy attenuation and conductivity of the roads contraction with depends.

4. Dopants Effect: Sulphate acid with protonated polyaniline samples phosphate acidic to samples relatively high electricity stability showed that the dopants nature polyaniline crystallinity level and conductivity to the mechanisms impact showed.

IV. DISCUSSION

Research results this shows that polyaniline electricity conductivity to the temperature related without changes and is known temperature in the range maximum to the level enough. Electronic mobility increase as a result conductivity increases, but high at temperature polymer degradation to the surface is coming.

From this except at low temperatures of electrons kinetic energy decreasing, quantum effects under the influence conductivity decreases. This features polyaniline temperature sensors, supercapacitors and energy storage in systems application for important importance has.

V. CONCLUSION

Research results polyaniline various temperature in the ranges used electronics on devices application opportunities open Research this showed that polyaniline electricity conductivity temperature to the range related without varies between 150-200°C maximum to value enough. High at temperatures thermal degradation to the surface comes, at low temperatures and kinetic of energy decrease because of conductivity decreases. Sulfate acidic dopants high electricity stability provides.

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