

## The Effect of Variation Sensitivity Against Time for Magnesium Oxide (MgO) Doped Polyaniline Nanocomposites Influenced by Ammonium Persulfate

Manjunatha B<sup>1\*</sup>, Nagajyoti<sup>2</sup>, Rahul Jabnoor<sup>3</sup>, Vinayak G K<sup>4</sup>, Arun Kumar Lakshetty<sup>5</sup>, Sangshetty Kalyane<sup>6</sup>

<sup>1</sup>Department of Physics Gulbarga University kalaburagi PG center Raichur -584133 Karnataka, India

<sup>2,3,6</sup>Department of Physics Bheemanna Khandre Institute of Technology Bhalki- Karnataka

<sup>4</sup>Department of Physics Government First Grade College Jewargi- 585310, India

<sup>5</sup>Department of Studies in Chemistry, Vijayanagara Sri Krishnadevaraya University, Ballari, Karnataka, 583105, India

### \*Corresponding author

Manjunatha B, Department of Physics Gulbarga University kalaburagi PG center Raichur -584133 Karnataka, India.

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### Abstract

Polyaniline and doped polyaniline were prepared by the method of insitu chemical oxidative polymerization with ammonium persulfate as an oxidant agent. The composite polyaniline was mixing the magnesium oxide and polyaniline with the PANI matrix distributions. Polyaniline composite of MgO characterized like as x-ray diffractometer shows structural properties. The electrical properties of polyaniline and composite polyaniline as a conductivity increases with increase in frequency. The sensor property shows the sensitivity with the help of time obtained the sensitivities values the ranges from 120 to 160% from these composites in 50% composite the sensitivity is high.

**Keywords:** Polyaniline, MgO, XRD, Sensors

### Abbreviations

PANI -Polyaniline

XRD - X-Ray Diffraction

AC - Conductivity

APS - Ammonium Persulphate

MgO - Magnesium Oxides

### Introduction

Now a days the interesting research area is polymeric material due to reality of these materials have large potentially device of the solid states. The mainly study conductivities of the polymer is PANI an organic conductivity polymeric confirm the performance mutually a conductors and semiconductors obtain throughout the chemically and electrochemically route [1]. Polymer substance has urbanized into area of growing concentration in examine since the in sequence of this substance contain enormous possible the state of solid tool [2]. Conductive polymeric materials were conjugate organically chain compound that shows large electrically conducting like to metal since here huge carrier concentration of extensive  $\pi$ - electron, well-known as polaron, which permit the charging mobility along the strength of character of the polymeric chains. The polymer contains numbers of advantage likes less- weight, flexibilities, less costs. The polymeric conductive materials have much application such as cellular telephones, television sets, displays, solar cells light emitting diodes, actuators, sensors, batter-

ies, electromagnetic shield, and microelectronic device among the conductive polymer, PANI has been of exacting curiosity due to its handy electrically conducting, more absorptions coefficient in the noticeable light, attractive redox properties, good chemical stabilities, relative highly conducting, easy polymerizations [2-8]. Polyaniline (PANI) survive in a different number of forms can be different in the chemically and physically property [9-11]. Leuco emeraldines is a completely reduces form and is yellowish color, nigranilines is blueish color, proto emeraldines is brownish color, emeraldines is greenish color and Pernigranilines is violet color. A variety of oxidize agent/monomers ratio have been used. Ammonium peroxydisulfate is usually used as oxidizing agent. There are quinonoid and benzenoid resonances according to amines and imines structure. Change the ratios of amines to imines, a variety of structure are formed [12-13]. By the oxidizes with HCL, ADC, APS produces the pernigrandline, Emeraldine and nigraniline in extreme crystalline [14]. The PANI/MgO nano-composite that have large property like being unscented and the non toxics as well as possessing highly hardenings, superior purities and highly melting points the magnesium oxide may be an add-on advantage in these fields of polymer; in exacting, it may give superior applications while doped to PANI. The property of the magnesium oxides like high hardening and highly melt points can be used as refractory's agent. Little previous information explains the sensitivities and selectivity's in the research of nanostructure PANI with the

adding together of different metals oxide [15-16]. Nanostructure metals oxide are promise original material for blends with polymer, due to brilliant mechanically, electrically, thermally and multifunctional properties. Separately from the physical properties of composite magnesium oxides these nanocomposites have shown good [17]. Sensor instrument is converter measure the physical quantities converts the signal which can be note down the instrument. In case the mercury in a thermometer move 1 centimeter when the temp change by 1°C, the sensitivity is 1 cm/°C. Sensors that evaluate very little change must have extremely high sensitivity. Sensors also have a force on what they measure [18].

## Materials and Methods

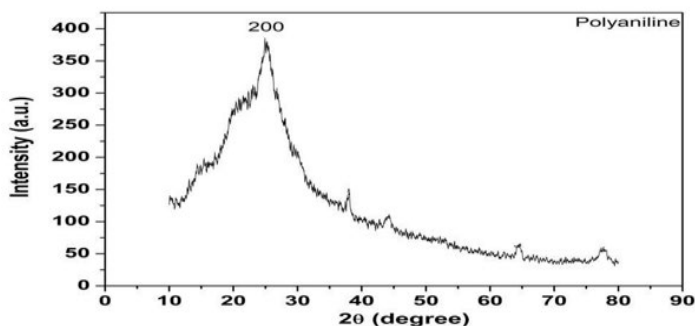
All Chemicals used were analytical reagent (AR) grade. Ammonium persulphate ((NH<sub>4</sub>)<sub>2</sub>S<sub>2</sub>O<sub>8</sub>), Hydrochloric acid (HCL), Magnesium Oxide (MgO) were procured from Sigma Aldrich and were used as received.

## Synthesis of Polyaniline –MgO Composites

0.2 mol of aniline was dissolved in 2 M HCl to form aniline hydrochloride. Magnesium Oxide (MgO) is added in the different weight percent to aniline hydrochloride solution with vigorous stirring in order to keep the Magnesium Oxide (MgO) suspended in the solution. To this reaction mixture, 0.2 M of ammonium persulphate [(NH<sub>4</sub>)<sub>2</sub>S<sub>2</sub>O<sub>8</sub>] which acts as the oxidant was added slowly with continuous stirring for 4 – 6 hours at 0 - 5° C. The precipitate powder recovered were vacuum filtered and washed with water and acetone. Finally, the resultant precipitate was dried in an oven for 24 hours to achieve a constant weight. In this way, five (5) different polyaniline Magnesium Oxide (MgO) composites with different wt % of MgO have been synthesized.

## Results and Discussion

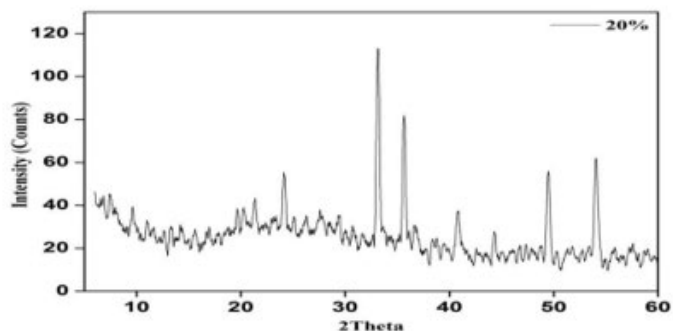
**XRD:** XRD patterns of PANI nanocomposite samples were obtained using an advance diffractometer with monochromatic CuK $\alpha$  radiation ( $\lambda=1.54$  A) to identify the crystalline nature of the samples.



**Figure 1:** XRD Pattern of Pure PANI

Fig 1 is the X-ray diffraction patter of pure polyaniline. Usually polyaniline is amorphous in nature. The broad peak was observed in the 2θ ranging from 25-27°, which is the main characteristics peak of polyaniline and the broadness of the peak clearly shows

the sample is amorphous, indicating that PANI exhibited some degree of crystallinity.



**Figure 2:** Shows the X-ray Diffraction Pattern of PANI – MgO Composite With 20 wt %

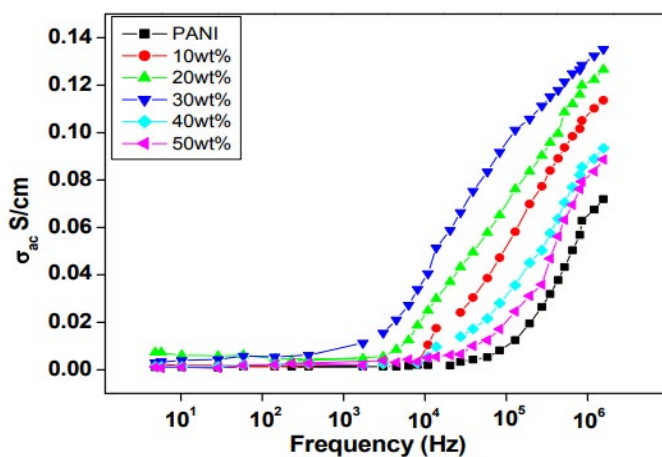
Fig 2 explains the composite PANI - MgO. Obtain be able to be indexed to be cubics stature explain the X-ray diffraction outline of Polyaniline – MgO composite with 20 wt % of MgO in polyaniline. The above fig says that crystallinities of compound diminish since shapeless environment of composite PANI [19].

## Electrical Properties

### AC-Conductivity

#### Polyaniline-MgO Composites

The fig 3 shows tells that it is observes the AC conductivities of the all composite leftovers the stable and prove alike performance up to 105 Hz, past this regularity it raises abruptly. And activities are the characteristics of disordering material, and this attributes in variations of distributions of magnesium oxides particle in matrix of the polymeric. Gasses sensors is a machine to facilitate can modify the attentiveness of an analyte gas into an electronical or electrically signals [20-21].

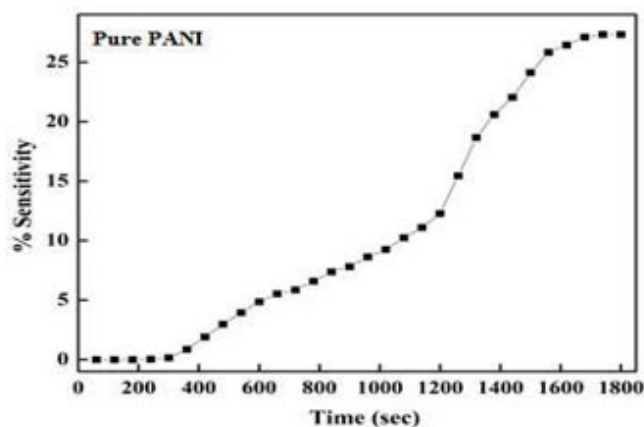


**Figure 3:** Variation of  $\sigma_{ac}$  as a Function of Frequency for PANI

## MgO Sensor Studies

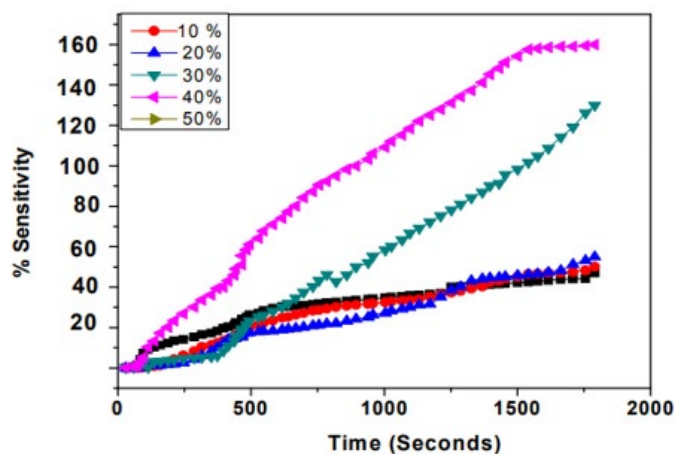
The gassing sensors properties is a like chemically sensors it operating gaseous phases and also this is significant components de-

vice generally recognized as “ electrical noses [22]. Fig 4 shows the difference of sensitivities with time for pure Polyaniline. It recorded the sensitivity values the pure PANI sensing range is 27%.



**Figure 4:** Difference of Sensitivities Versus Time for Pure PANI

Fig 5 shows the sensitivity against time for PANI-MgO composite it recorded the sensitivities values the ranges from 120 to 160% obtained from composites 40 and 30 the all different wt percentages compared to 50 wt composite because 50 wt percent composite the sensitivity is high [23-25].



**Figure 5:** Difference of Sensitivities Next to Time for PANI-MgO

## Conclusion

The PANI and PANI/MgO composites were prepared by chemically oxidative using aniline hydrochloride as a monomer. The XRD studies confirmed the formation of PANI and its composite and it indicates that PANI/ MgO composite have an orderly arrangement of the polymer chain, whereas these PANI nanostructures are slightly crystalline in nature. SEM images helped to draw the conclusion that the doping of MgO had an effect on PANI morphology, and with increased MgO content, the composites showed a transformation in morphology from typical granular and nonporous PANI particles. Further these nano composites had also proved beneficial for using Gas sensors have found wide ap-

plications in industrial production, environmental monitoring and protection.

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