Sensing and Electrical properties of Tungsten oxide polyanilinenanocomposites

1. Imlichuba Jamir
B.Tech Student Mechanical Engg.
Farah Institute Of Technology
Hyderabad, India

2. Sarlok Terang
B.Tech Student Mechanical Engg.
Farah Institute Of Technology
Hyderabad, India

3. Temhreth.N
B.Tech Student Mechanical Engg.
Farah Institute Of Technology
Hyderabad, India

4. Tangsoi Khiamniugan
B.Tech Student Mechanical Engg.
Farah Institute Of Technology
Hyderabad, India

5.Anwarullah.M
Prof.Mechanical Engg.
Farah Institute Of Technology
Hyderabad, India

6. Jakeer Hussain
Department Of Physics Kbnc Of Engg.Gulbarga ,Karnataka ,India

7.Peram Kondala Rao
Prof.Mechanical Engg.
Farah Institute Of Technology
Hyderabad, India

Abstract -

The WO_3-Paninanocomposites were synthesized byin-situ polymerization method. It is a simple and lowcost method to prepare nanocomposite. The preparedsamples were characterized by using ScanningElectron Microscope (SEM) to getsurface morphology, idea of getting particles ofnanosized range so that further characterization canbe done, to study the sensing properties ofsynthesized nanocomposite and measure.

Key words: Tungsten Oxide ,nanoparticles, polyaniline, Electrical properties.

1. Introduction

Polymers are generally insulators and to exhibit electricalconductivity they must possess, ordered conjugation withextended (pi) electrons and large carrier concentrations.Conjugated polymers are the organic compounds thathave an extended (pi) orbital system and conjugated carbonsystem [1]. Conductive polymer with polyaromaticbackbone including polypyrrole, polythiophene, polyaniline,etc. has received a great deal of attention in the lasttwo decades [2].

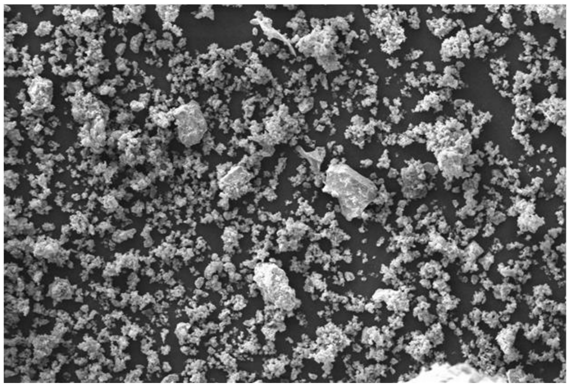
In this direction polyaniline(PANI) has been studied and investigated extensively withrespect to facile synthesis by chemical and electrochemicalprocess, environmental stability, low cost, high conductivity,solubility, and chemical sensitivity. It has drawn considerableattention for its wide application in microelectronic devices,photodiodes, sensors, light weight batteries, solar cells,electrochemical capacitors, corrosion capacitors, corrosioninhibitors, drug delivery and electromagnetic interferenceshielding materials. Various composites of PANI withdifferent fillers or dopants like MoO3, MnO3, WO3, TiO2,BF3, CNTS etc. have been synthesized, characterized andexplored for various possible applications3-6.

2 Preparation of Polyaniline/Tungsten oxidenanocomposites

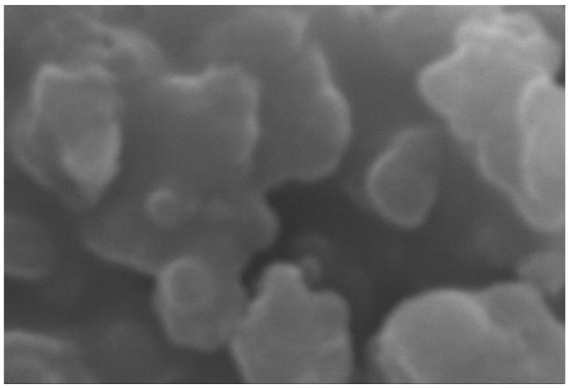
Synthesis of the PANI– Tungsten oxide nanocomposites was carried out by in-situ polymerizationmethod. Aniline (0.1 M) was mixed in 1 M HCl and stirred for 15 min to form aniline hydrochloride. Tungsten oxide nanoparticles were added in the mass fraction to the above solution with vigorousstirring in order to keep the Wo_3 homogeneously suspended in the solution. To this solution,0.1 M of ammonium persulphate, which acts as an oxidizer was slowly added drop-wise withcontinuous stirring at 5◦C for 4 h to completely polymerize. The precipitate was filtered, washed withdeionized water, Acetone, and finally dried in an oven for 24 h to achieve a constant mass. In theseway, PANI– Tungstennanocomposites containing various weight percentage of Tungsten (10 %, 20 %, 30 %,40 %, and 50 %) in PANI were synthesized.

3 Result and Discussion

3.1 Scanning Electron Microscope



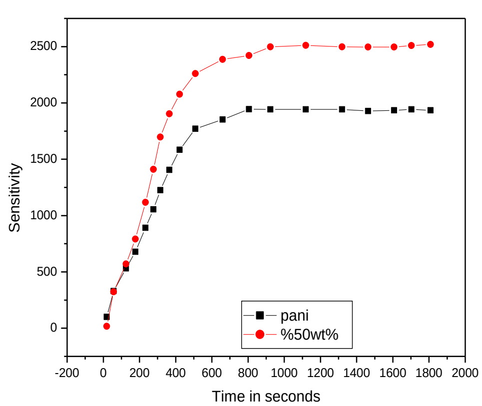
Wo3



Wo3 /Pani Composites

.It is observed from the figure that the distribution of Wo3 nanoparticles in the PANI matrix is homogeneous and the sizes of the Wo3 nanoparticles are measured as 52 and 67 nm as indicated by the rectangle.

4 Sensing properties



From figure .4 it clearly seen that the difference in Sensitivity with time when pellets are exposed to LPG. from figure the linear increment in sensitivity upon exposure to LPG vapor ,it increase up to some time and decreases after being transferred to clear air. Among all the PANI/ tungsten oxidenanompposites, 50 wt% are showing maximum Sensitivity when compared to pure PANI This is due to reaction between the metal oxide and LPG. .In the case of PANI alone the change in sensitivity is very low due to lower adsorption because of lower surface area.

5 DC conductivity

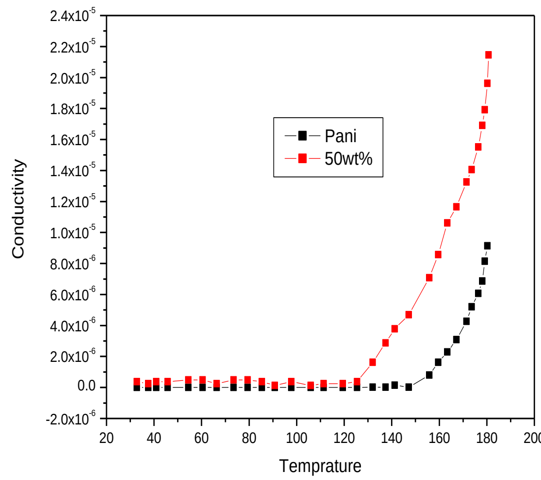


Figure 5 shows theTemperature dependence of conductivity of pure PANI, PANI/ tungsten oxidenanocomposites. The electrical conductivity behavior of the nanocomposite were measured with increasing temperature (35^{o}c-180^{0}c) by using two probe DC electrical conductivity-measuring instrument. In the case of pure pani composites ,highest conductivity was observed.as compared to the pani composite this support the fact that nanoparticles is mainly responsible for electrical conduction

Conclusions

Tungsten nanocomposites were successfully synthesized by in-situ polymerization method. The results of SEM conformed the formation of the composite and indicate aninteraction between Pani and Tungstenoxide nanoparticles. The maximam conductivity and sensitivity is observed for50wt% of Tungsten oxide nanocomposites and it decreases with decreasing in the concentration of Tungsten oxide, and the composites particles exhibit a better sensitivity to vapors compared with Pani. Theprepared nanocomposites show supermagnetic behaviors and hence this composite is a promisingmaterial for potential and sensing applications.

REFERENCES

1 G. B. Shumaila, V. S. Lakshmi, M. Alam, A. M. Siddiqui, M. Zulfequar and M. Husain, "Synthesis and Characterization of Se Doped Polyaniline," Current Applied Physics, Vol. 11, No. 2, 2010, pp. 217-222. doi:10.1016/j.cap.2010.07.010

2K. Gupta, P. C. Jana and A. K. Meikap, "Optical and Electrical Transport Properties of Polyaniline-Silver Nanocomposite," Synthetic Metals, Vol. 160, No. 13-14, 2010, pp. 1566-1573.
References

3. Asim N, Radiman S and Yarmo MA. Preparation and characterization of core–shell polyaniline/V2O5 nanocomposite via microemulsion method.Materials Letters. 2008; 62(6):1044- 1047. http://dx.doi.org/10.1016/j.matlet.2007.07.051.

4. MacDiarmid AG. Synthetic metals: a novel role for organic polymers. Synthetic Metals. 2002; 125(1):11-22. http://dx.doi. org/10.1016/S0379-6779(01)00508-2.

5. Chen SA, Chuang KR, Chao CL and Lee HT. White-light emission from electroluminescence diode with polyaniline as the emitting layer. Synthetic Metals. 1996; 82(3):207-210. http://dx.doi.org/10.1016/S0379-6779(96)03790-3.

7. Heeger AJ. Semiconducting and metallic polymers: the fourth generation of polymeric materials. Synthetic Metals. 2002; 125(1):23-42. http://dx.doi.org/10.1016/S0379-6779(01)00509-4.

8. Mohan VM, Chen W and Murakami K. Synthesis, structure and electrochemical properties of polyaniline/MoO3 nanobelt composite for lithium battery. Materials Research Bulletin. 2013; 48(2):603- 608. http://dx.doi.org/10.1016/j.materresbull.2012.11.041