International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
doi : https://doi.org/10.32628/IJSRST218328

Synthesis and Characterization of Conducting Polymer

Deepak A Zatale[1], Satish T. Rathod[2], Kalpana N. Pawar[3]
[1]Department of Physics, Govt. College of Engineering, Amravati, Maharashtra, India
[2]Department of Mathematics, Shri. Maturadas Mohata Science College, Nagpur, Maharashtra, India
[3]Department of Mathematics, Shri. R. R. Lahoti Science College, Morshi, Amravati, Maharashtra, India

Article Info
Volume 8, Issue 3
Page Number : 113-116

Publication Issue
May-June-2021

Article History
Accepted : 07 May 2021
Published : 13 May 2021

ABSTRACT

In recent technology, considerable attention was given to the fabrication of light weight rechargeable batteries, electro chromic display devices, microelectronics, sensor and molecule design etc. As one of the most important conducting polymers, polyaniline because of its chemical stability and relatively high conductivity and its derivatives have been extensively studied in different fields of science, because of the demand for high performance materials in advanced technologies. However, the common uses of polyaniline are restricted, due to its poor process ability and low solubility. Various techniques were given for synthesis of conducting polymer. In the current studies, polyaniline (PANI) and its composites with semiconductor was prepared chemical oxidation method in the presence of different bronsted acids from aqueous solutions. The effect of thermal treatment on electrical conductivity (DC), of the pure PANI, PANI+10%, 15% and 20% $MnSO_4$ conducting polymers were investigated. It is found that conductivity of PANI enhancing due to stretching polymeric chain cause due to interaction with $MnSO_4$.

Keywords : Conducting polymer, DC Conductivity

I. INTRODUCTION

In the last two decades the field of conducting polymers has shown tremendous growth and it is now an important field of research, the conducting polymer when functionalized with other conjugate system can be very useful; in many applications. As seen in the literature survey the functionalization with macrocyclic molecules has been mainly used in electrode preparation for reduction of oxygen, the detailed study on functionalization of conducting polymers such as polyaniline with $MnSO_4$ is now reported so far. In order to have better understanding of physics of this material the present work was undertaken. The investigation are mainly clamed at looking at the structural changes taking place due to incorporation of $MnSO_4$and the effect of $MnSO_4$ on properties such as electrical conductivity, frequency response, and dielectric constant of the resulting polymer composite. In the present investigation, one

method for synthesizing the conducting polymer composite has been employed. The polymer composite obtained from the method are expected to he thermally stable due to presence of $MnSO_4$. In the doped state these are expected to give higher conductivity because of enhance conjugation level. It is also interesting to see the structural modification imported in the product because of addition of $MnSO_4$.

II. EXPERIMENTAL

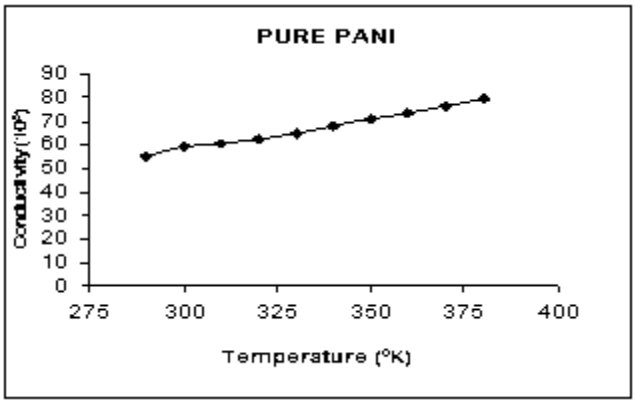
DC Electrical Conductivity:

Electrical conductivity of the synthesized conducting polymer was measured by resistivity measurement technique. The resistance in the pellet form prepared under the hydraulic pressure was done by conventional method. There are two methods generally employed for resistance measurement of the sample. a) Four probe method. b) Two probe method or LCR technique.

TABLE AND GRAPH:

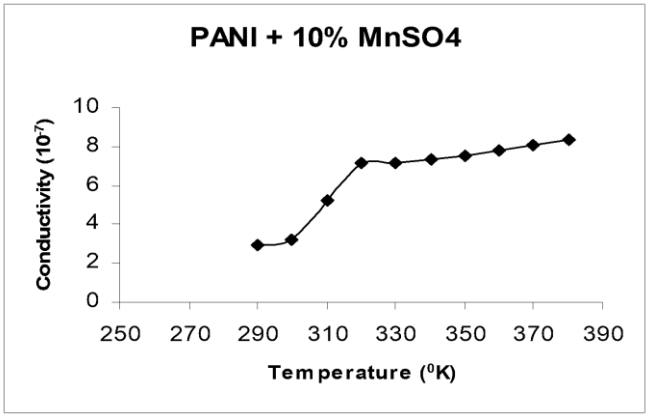
1) Pure PANI r= 0.997cm t=0.47cm A=3.14cm² V=5volts

Temp ^0K	Current μA	Resistance Ω *10⁶	Specific resistivity (ρ) Ω cm *10⁸	Conductivity σ $cm^{-1}*10^{-8}$
290	0.420	11.9047	1.2573	55.213
310	0.435	11.4942	1.3022	59.1223
320	0.455	10.9890	1.3621	60.738
300	0.470	10.6382	1.4070	62.44146
330	0.495	10.1010	1.4818	64.8634
340	0.515	9.7087	1.5417	67.8634
350	0.535	9.3457	1.6015	71.0732
360	0.550	9.0990	1.646	73.4160
370	0.565	8.84955	1.6914	76.39311
380	0.605	8.26244	1.811	79.5544



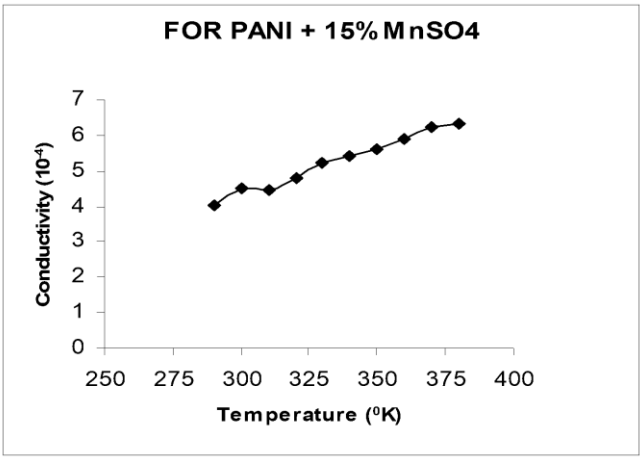
2) PANI +10% $MnSO_4$ r = 0.996 cm. t = 0.313 cm

Temp ^0K	Current μA	Resistance Ω *10⁶	Specific resistivity (ρ) Ω Cm *10⁶	Conductivity σ $S\ cm^{-1}*10^{-7}$
290	0.910	5.4945	3.363	2.9734
310	0.980	5.1020	3.122	3.2022
320	15.90	3.1446	19.2479	5.1922
300	21.8	2.2935	14.038	7.1231
330	22.0	2.7272	13.911	7.1885
340	22.5	2.2222	13.6019	7.3519
350	23.0	2.1739	13.3062	7.5152
360	24.0	2.0833	12.7517	7.8420
370	24.8	2.0162	12.3404	8.1020
380	25.5	1.9607	12.0016	8.3323



3) PANI + 15% $MnSO_4$ r = 0.998 cm. t = 0.490 cm. A =3.14 cm^2

Temp ^0K	Current mA	Resistance $\Omega *10^3$	Specific resistivity (ρ) Ω Cm $*10^3$	Conductivity σ $cm^{-1}*10^{-4}$
290	12.90	0.387	2.483	4.0261
300	14.45	0.340	2.217	4.5098
310	14.90	0.3355	2.1503	4.4650
320	15.35	0.3257	2.0873	4.7901
330	16.80	0.2976	1.9071	5.2433
340	17.40	0.2873	1.8414	5.4305
350	18.00	0.2777	1.7800	5.6178
360	18.95	0.2638	1.6908	5.9143
370	19.95	0.2506	1.6060	6.2264
380	20.25	0.2469	1.5822	6.3206

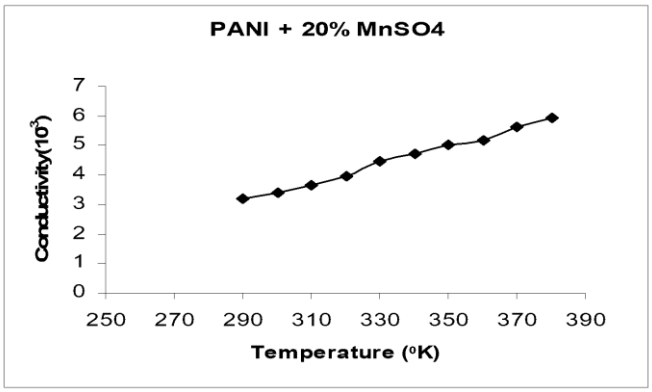


4) PANI + 20% $MnSO_4$ r = 0.997cm. t = 0.404 cm. A = 3.14cm^2

Temp ^0K	Current mA	Resistance $\Omega *10^3$	Specific resistivity (ρ) Ω Cm $*10^3$	Conductivity σ $cm^{-1}*10^{-3}$
290	124.0	0.040	0.313	3.1934
310	132.4	0.037	0.2935	3.4069
320	142.1	0.035	0.2734	3.6565
300	154.7	0.032	0.2510	3.9808
330	172.5	0.028	0.2252	4.4388
340	183.5	0.0272	0.2177	4.7219
350	195.4	0.0255	0.1988	5.0281
360	200.9	0.0249	0.1934	5.1696
370	218.3	0.0229	0.1780	5.6174
380	229.9	0.0217	0.1690	5.9158

III. RESULT

From the above graph it is indicates that the conductivity of pure polyaniline with H_2SO_4 is explained by hopping mechanism other graphs conductivity of polymers now follows very well. So conductivity of polymer is explained by polaron, biopolarons i.e. hoping mechanism.



As the composition $MnSO_4$ is added in pure PANI with H_2SO_4 the conductivity of a compound increases. This increase in conductivity shows that the compound become more stretched as compare to pure PANI. As the composition % increases in PANI nature of graph tells that the semiconductor nature arises in compound. As the temp increases, composite PANI shows the semiconductors enhancing conducting property.

IV. CONCLUSION

From the above studies we have observed that the value of D.C. & A.C. conductivity unusually enhanced by doping polymerization of polyaniline.

Again these conductivity enhanced by polymerization with $MnSO_4$ semiconductor powder. The enhancing conductivity has been attributed due to stretching polymeric chain cause due to interfacial interaction with $MnSO_4$ crystallides. This conductivity in pure PANI and its composites is due to hopping mechanism.

V. REFERENCES

[1]. H.C.Pant, M.K.Patra, S.C.Negi,A Bhatia S.R. Vadera & N Kumar Bull. Mater Sci. 29 (2006) 379.

[2]. Polymer engineering science. M.Blaszkiewicz, D.S. Mchlachian

[3]. S.Radhakrushanan and A.K Arof, Polymeric Materials,Naro , Publ.Hou.(1998).

[4]. R Murugesan and E Subramanian Bull. Mater Sci. 26 (2003) 529.

[5]. C O Yoon, M Reghu, D Moses, Y Cao and A J Heeger Synth. Met. 26 (1995) 255.

[6]. J Joo, S M Long, J P Pouget, E J Oh, A G MacDiarmid and A Epstein, Phys. Rev. B 57(1995) 67.7)

[7]. I. Harada, Y.Furukawa and F Ueda Synth. Met.29 (1998) 303. B.Wessling Synth. Met 102 (1999) 1396.

[8]. J Yang, J Hou,W Zhu, Xu and M Wan Synth. Met. 80 (1996) 283.

[9]. An introduction to polymer science. Hans By Georg Elias

[10]. polymer science By Gowarikar

[11]. Polymer and advanced material. A.G. MacDiarmic & A Epstein

Cite this article as :

Deepak A Zatale, Satish T. Rathod, Kalpana N. Pawar, "Synthesis and Characterization of Conducting Polymer", International Journal of Scientific Research in Science and Technology (IJSRST), Online ISSN : 2395-602X, Print ISSN : 2395-6011, Volume 8 Issue 3, pp. 113-116, May-June 2021. Available at doi : https://doi.org/10.32628/IJSRST218328

Journal URL : https://ijsrst.com/IJSRST218328