

GLOBAL JOURNAL OF ENGINEERING SCIENCE AND RESEARCHES CONTRIBUTION OF POLYMER MATERIAL FOR THE APPLICATION AS CONDUCTING MATERIAL AFTER DOPING

Anubha Vijay Pandya^{*1}, Aayush Soni², Dharmendra Singh Rajput³, and Vaishali Patel⁴

^{*1,2,3&4}Department of Chemical Sciences, Christian Eminent College, Indore (M.P.) India

ABSTRACT

Polyethylene is the simplest hydrocarbon polymer and was first produced in England by the empirical chemical industries in 1933 by polymerizing the ethylene monomer. After that some more meetings were arranged by Faraday society and IUPAC in 1935 and in 1947 by society of polymer scientists. They considered studies on polymerization reactions. During the period 1920-1960 quite a good number of polymers were prepared 1920-1960 quite a good number of polymers were prepared. Since then the development of the field of conducting polymers has continued to accelerate at an unexpectedly rapid rate. In this development there have been contributions from a wide spectrum of scientists such as chemists, physicists, polymer materials scientists such as chemists, physicists, polymer materials scientists such as chemists, physicists, polymer materials scientists, spectroscopists, electronic and electrical engineers, thereby making this field as one of the most interdisciplinary fields of science today. The chemical and electrochemically induced doping process greatly modifies the conducting properties of the polymers. These doped polymers are called polymeric semiconductors. Doping in polymeric semiconductors is different from that in organic or traditional semiconductors is different from that in organic or traditional semiconductors.

Keywords: doping ,oxidizing, reducing, electrochemical treatment, insulating, fibril.

I. INTRODUCTION

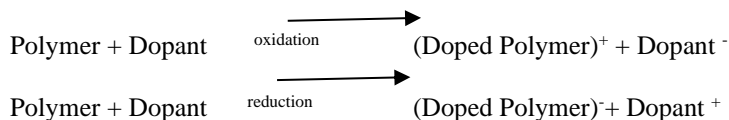
Polymer scientists were trying to take advantage of polymers in various fields, such as; to bond objects, sealjoints, fill cavities, bear loads, etc. polymers were used as conducting materials too. In 1977 it was reported that polyethylene treated with iodine could show conductivity values up to 10^3 s/m which triggered a world-wide research and publication activity. Iodine doped polyacetylene is not only conducting polymer, many polymers become conducting upon “doping with an oxidizing/reducing agent.

In 1977 Mac Diarmid, Heeger, Shirraltawa and coworkers showed that polyacetylene could be p- or n- doped ,either chemically or electrochemically ,to nearly metallic state. Polymers can be use by converting them from insulating to conducting polymers.

Doping of conducting polymers involves random dispersion or aggregation of dopants in molar concentrations in the disordered structure of entangled chains and fibrils. The dopant concentration is as high as 50% doping of polymers may be carried out by the following methods:

- a) Gaseous doping
- b) Solution doping
- c) Solution doping
- d) Electrochemical doping
- e) Self doping
- f) Radiation Induced doping
- g) Ion exchange doping

Out of these doping techniques, the solution doping procedure is generally used. In solution doping toluene, acetonitrile, tetrahydrofuran, nitro methane and other similar polar solvents are used as solvents. The polymer is treated with the dopant solution. Since dopants are strong oxidizing or reducing agents, on doping positive or negative charge carriers and developed in the polymers. This may be represented by the following simplified scheme of reaction



These polymer electrolyte and polymer electrodes contain two types of conductance i.e. ionic and electronic conductance respectively.

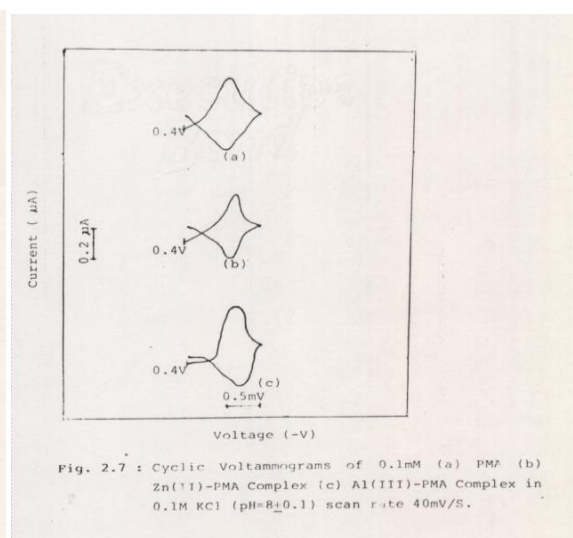
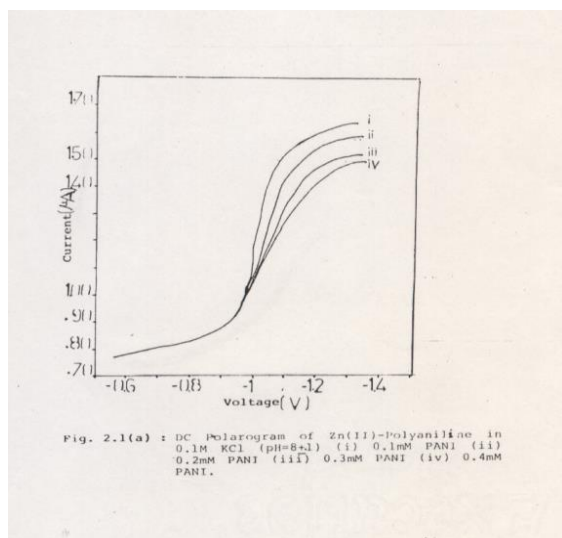
II. CHARACTERIZATION

The optical spectra of silver Nanocomposites¹ of polypyrrole were record by UV-3600, Shimadzu spectrophotometer. Xray diffraction measurement was done by XRD 6000 Shimadzu diffractometer and by using Cu α (0.154 nm) radiation at the room temperature. The average size of the Nanocomposites Was recorded by scanning electron microscope (FESEM) operated at 10.0 kV².

Some polarographic parameters observed for doped Polyaniline and (Zn-PANI) complex

Concentration mM	I_d μ	$E_{1/2}$ V vs SCE	E_{pa} v	E_{pc} v	$E_{pc} - E_{pa}$ v
0.1	1.1	-1.10	1.08	-1.12	-0.04
0.2	1.0	-1.10	1.08	-1.12	-0.04
0.3	0.9	1.10	1.08	1.12	0.04

Some polarographic parameters observed for doped Polyaniline and (Zn-PANI) complex



III. RESULTS AND DISCUSSION

the UV-Vis spectra of PPy and PPy/Ag Nanocomposites respectively^{3,4,5,6}. PPy exhibit absorption peak at 446 nm which are in support with literature values [12]. The UV-Vis absorption spectrum of the PPy-Ag Nanocomposites is shown in Figure1(b). Figure1. UV-vis spectra of PPy (a). Two typical absorption bands at 465 and 545 nm, which correspond to the π - π^* transition and bipolaron transition of the PPy chain, respectively. The absence of the strong surface Plasmon resonance of metal silver around 450 nm for the PPy-Ag Nanocomposites^{7,8,9} reveals that Ag is dispersed as very small particles of elementary silver within the PPy-Ag, Nanocomposites^{10,11,12,13,14}

IV. CONCLUSION

By now these polymers are showing commercial promise in such areas as power equipment, light weight and rechargeable batteries, micro machines and adhesives, and many more applications have been proposed using these exciting systems. Polymer synthesis is not difficult today, because of the abundant availability of literature on the subject. Thus to synthesize a few tons of polymers, all we need is the appropriate quantity of the monomer and catalyst and a suitable polymerization reactor. This will enhance the material range to apply as semiconducting polymeric material.

REFERENCES

1. V.R Gowariker, N.V. Viwanathan, Jayadev Sreedhar, Polymer Science Willey Eastern Ltd., (New Delhi) (1990).
2. C.A. Vincent; Progress in Solid State Chemistry, 17, 145 (1987).
3. Sacchidanand S. Shinde Vol. 3, Issue 6, June 2014 International Journal of Innovative Research in Science, Engineering and Technology
4. Shirakawa, H.; Louis, E. J.; Macdiarmid, A. G.; Chiang, C. K.; Heeger, A. J. Journal of the Chemical Society-Chemical Communications 1977, 578-580 [2] D.A. Jones, Principles and Prevention of Corrosion, Macmillian, New York, 1992.
5. P.C. Searson, T.P. Moffat, Crit. Rev. Surf. Chem. 3 (3-4) (1994) 171.
6. G. Nagels, T.R. Winard, A. Weymeersch, L. Renard, J. Appl. Electrochem. 22 (1992) 756.
7. M. Schirmeusen, F. Beck, J. Appl. Electrochem. 19 (1989) 401.
8. P. Hulser, F. Beck, J. Appl. Electrochem. 19 (1989) 401.
9. Pei, Q. B.; Inganas, O. Advanced Materials 1992, 4, 277-278
10. Diaz, A. F.; Bargon, J. In Handbook of Conducting Polymers; Skotheim, T. A., Ed.; Marcel Dekker: New York, 1986; Vol. 1, pp 81- 116.
11. Hirakawa, H. In Handbook of Conducting Polymers; Skotheim, T. A., Elsenbaumer, R. L., Reynolds, J. R., Eds. Marcel Dekker: New York, 1998; pp 197-208
12. Visy, C.; Lukkari, J.; Kankare, J. Macromolecules 1993, 27, 3322.
13. Visy, C.; Lukkari, J.; Kankare, J. J. Electroanal. Chem. 1996, 401, 119
14. Z. L. Wang, X. Y. Kong, Y. Ding, P. Gao, W. L. Hughes, R. Yang and Y. Zhang, "Semiconducting and Piezoelectric Oxide Nanostructures Induced by Polar Surfaces," Advanced Functional Materials, Vol. 14, No. 10, 2004, pp. 943-956. doi:10.1002/adfm.200400180.