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Nanostructured Organic Polyaniline Thin Film Prepared By Polymerisation Technique

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ABSTRACT

Nanostructured Organic Polyaniline (PANI) thin film, doped with an inorganic acid (HCL), on glass substrate was directly synthesized by using the in situ polymerization technique. HCL doped PANI thin film is sense LPG gas at room temperature. The optical and electrical properties of were studied by UV-Vis spectrophotometer and I-V Characteristics. The mechanism of formation of polyaniline on glass substrate was confirmed by UV spectroscopy.

Keywords: PANI, Polymerization, Optical and electrical.

I. INTRODUCTION

Conducting polymers have greater advantage as they are simple to synthesize, with their chemical structure tailored to alter their physical properties, such as their band gap. They exhibit an extensive range of electrical conductivity. Further to their ease of synthesis and with lower cost, they are known to have low poisoning effects. They possess a large variety and versatility in their chemical structure and are therefore extensively used in devices for the detection of environmentally hazardous chemicals [1]. The most commonly studied classes of conducting polymer were: Polyacetylene, polythiophene, polypyrole, polyaniline and derivates, being investigated as conducting matrices for electro catalytic applications. Among them, polyaniline (PANI) is one of the most studied materials because of its high conductivity upon doping with acids, well behaved electrochemistry and easy preparation under reproducible conditions by electro - polymerization and chemical oxidation of aniline, chemical and electrical stability and good environmental stability [2].Electrically conducting polymers described as a new class of 'synthetic metals' reached a high interest in the last years.

Conducting polymers are suitable as electrode materials for high performance solar cells [3]. Conducting polymers had been the topic of the large number of investigations since past decades because of their unique properties such as mechanical strength, electrical conductivity, corrosion, stability and possibility of both oxidative and electrochemical synthesis. Of these polymers PANI has significant application in various areas like solar energy conversion, rechargeable batteries, electro chromic displays, electrochemical sensors, capacitors and active corrosion protector [4].Due to simplicity of its synthesis, processing environmental stability and low synthesis cost, so polyaniline is probably the most important industrial conducting polymer today . Conducting polymers usually have a good corrosion stability when in contact with solution or/and in the dry [5].

II. EXPERIMENTAL WORK

Optically pure glass plates were boiled in chromic acid and kept in it for 24 hrs, washed with laboline and dipped in distilled water and dried to remove contamination. The contaminated substrate surface provides nucleation sites facilitating growth, which results in non-uniform film growth. Polyaniline was prepared by chemical oxidation of 0.2 M of aniline sulfate with 0.25 M ammonium peroxydisulfate (APS) and 1 M concentration of HCl as dopant. Then 0.25 M APS solution was prepared in aqueous medium. Thereafter, 20 ml of APS was slowly added (drop wise) in 20 ml of as-prepared aniline solution with constant stirring at room temperature. Pre-cleaned glass substrate was inserted vertically in the mixed reactants for deposition of polyaniline film [6].

III.RESULTS AND DISCUSSIONS

Optical absorbance of the film is recorded on Perkin Elmer, Lambda-25 UV-VIS spectrophotometer in 300-1100 nm wavelength range. It was found that on passing electromagnetic radiation in the UV and visible region, a portion of radiation is normally absorbed by the film. The amount of absorption depends on the wavelength of the radiation and the structure of the material. The absorption of radiation is due to the subtraction of energy from the radiation beam when electronic orbital of lower energy are excited into orbital of higher energy i.e. an electron excitation phenomenon. UV spectra record the wavelength of an absorption maximum λ max. From the fig. absorption peak nearer to 350 nm is due to π^*-π^* transition of aniline. The higher wavelength of transition enhances the intrinsic conductivity of sample.

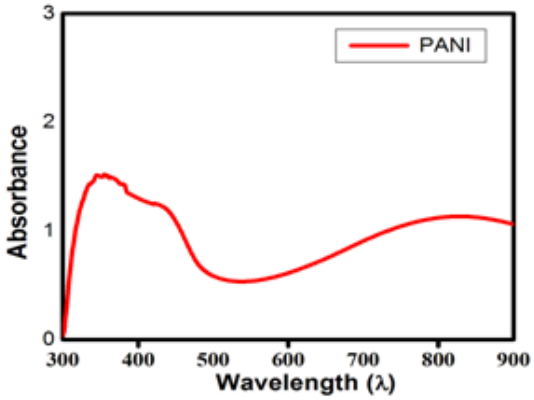

Fig 1. UV-Vis spectrum of PANI thin film.

The photo absorbing experiment was recorded by eliminating this film to100W per cm 2 light source ans data was retrieved from the computer interfaced with I-V measurement setup KEITHLEY 2400 source meter. PANI films are normally of p-type semiconductor. As during the polymerization process of aniline, acids (such as HCl) are used, which acts as dopant for PANI molecules, and usually bound with the central N atom of aniline (monomer) molecule, like H+ N Cl.

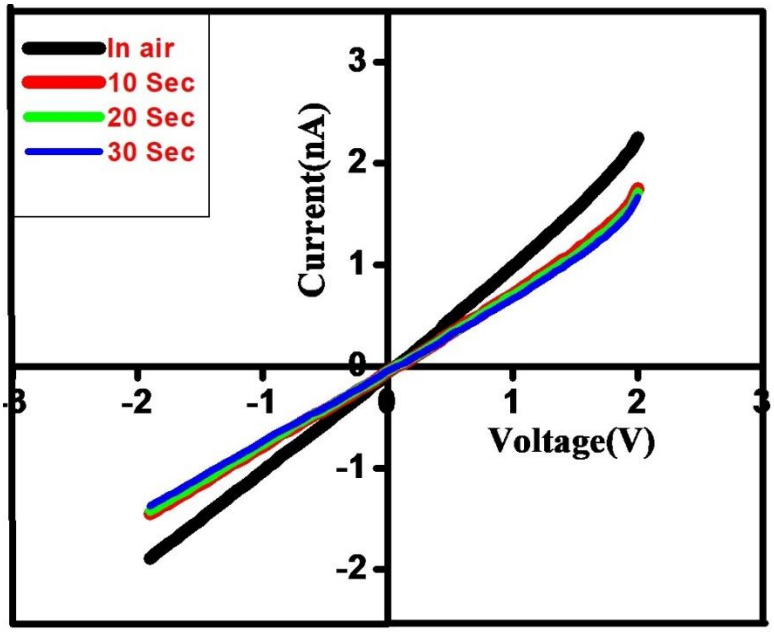

Fig.2 Forward bias I-V characteristics of HCl doped Polyaniline thin film in air and LPG atmosphere.

IV. CONCLUSION

Nanostructured Organic HCl doped Polyaniline thin film was prepared by chemical route method at room temperature. The mechanism of formation of polyaniline on glass substrate was confirmed by UV spectroscopy. The change in electrical resistance of polyaniline film shows I-V characteristics.

V. REFERENCES

[1]. K. M. Zaidan, H. F. Hussein, R. A. Talib, A. K. Hassan, Synthesis and characterization of (Pani/n-si)solar cell. Energy Procedia 6, 85-91 (2011)10.1016/j.egypro.2011.05.010).

[2]. D. Geethalakshmi a, N. Muthukumarasamy b, R. Balasundaraprabhu c Measurement on the structural, morphological, electrical and opticalproperties of PANI-CSA nanofilms, Measurement 92 (2016) 446–452

[3]. G.A.Rimbu,I.Stamatin,C.L.Jackson,K.Scott,The morphology control of polyaniline as conducting polymer in fuel cell technology,Journal of optoelectronics and advanced materials,vol.8,No.2,April2006,p.670-674.

[4]. Clara Jeyageetha J.*, Sankaragomathi V., Bharathi M., Muthumari R and Siji Priya P, Utilization of fly ash: synthesis, spectral, thermal studies of Pani-fa matrix composites, International Journal of Recent Scientific Research,Vol. 7, Issue, 11, pp. 14466-14473, November, 2016

[5]. Gita Rani, Electrical conductivity of hybrid materials of Polyaniline (pani) with tin International Journal of Advances in Science Engineering and Technology, ISSN: 2321-9009, Vol-4, Iss-3, Spl. Issue-1 Aug.-2016,176

[6]. A. G. Patil, A. P. Maharolkar, S. L. Patankar, A G Murugkar ,International Journal of advanced Research in Basic and Applied Sciences Special issue January 2017 pp.62-69

[7]. Ravikiran B Birajadar, Deepak Upadhye, Sandip Mahajan, JC Vyas, Ramphal Sharma, Study of room temperature LPG sensing behavior of polyaniline thin film synthesized by cost effective oxidative polymerization technique, J Mater Sci: Mater Electron (2015) 26:5065–5070.