SYNTHESIS OF POLYANILINE/ WO_3 COMPOSITES AND ITS CHARACTERIZATION OF COMPOSITE POLYANILINE

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Abstract

Science and technology of Nano scale materials is enriched by developing new synthetic technology and its applications in various fields. Recent development reviews the combustion method which is an efficient and simple method for the preparation of different materials and their composites. Metal oxide-based polymer Nano composites have gained much importance due to their special applications. In addition, interfacial polymerization method has gained its importance in the synthesis of composites by eco-friendly system. Nano sized metal aluminates such as **WO_3** and **WO_3** were prepared by a combustion route using poly(vinyl alcohol) as a fuel. Interfacial polymerization method was used for the preparation of polyaniline– **WO_3** (PANI/**WO_3**) Nano composites. These composites were well characterized for their structures by employing X-ray diffraction tool and morphology by scanning electron micrograph tool, respectively. In-depth morphology of the sample was well studied by transmission electron micrograph tool. The bonding nature of the sample was studied by Fourier transform infrared (FT-IR) study; and the presence of metals in the composites was confirmed by EDX pattern. Electrical and thermal studies of the PANI/ **WO_3** composites were conducted to understand their electrical and thermal behaviours, respectively. UV–visible and DLS studies of the prepared nanocomposite were also conducted to understand the absorbance and particle distribution, respectively.

Keywords: Pani, Xrd, Sem, Electrical Conductivity

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INTRODUCTION

The trend of attractive capable uses from the well-known conducting polymers of polyaniline, polypyrrole, polythiophene etc, is taking prominence in innovative scientific fields since from few decades. PANI is used in various fields, such as light emitting diodes, electronics, electrochemistry, optoelectronics, and electromagnetic interference shielding and electro chromic shows. moreover its research is easy, low cost, ecological stability is good, low density, enhanced electronic properties which gives possible applications such as sensors, rechargeable batteries, electro catalysis, and bio sensors, drug delivery etc.[1-5]. One of the most studied conducting polymers is polyaniline (PANI), an organic conducting polymer that shows the behaviour of both a conductor and a semiconductor, which can be obtained through chemical and electrochemical routes [6]. The important applications of conducting polymers such as reversibility, which can be ease to use for layering, shape, high-quality environment constancy improve their latent use for practically application. The mainly study the conduct polymer; PANI obtain chemically or electrochemically direct. Polymers have turn out to be an area of rising attention in investigate because of the detail that these material have huge possible for solid states device [7]. Polyaniline (PANI) exist with one of three states of oxidation. Fully reduced "leucoemeraldine" base is the oxidation state of the polyaniline. These are colourless, poor conductor (even when doped with acids) and which are very reactive. Fully oxidised pernigraniline base $(C_6H_4N)_n$ are another oxidation state of the polyaniline. They are blue/violet in colour, poor conductor and which is environmentally stable. Another most widely used oxidation state of the polyaniline are partially oxidised emeraldine base/salt with green in colour for salt and blue in colour for base, which is "environmentally unstable and does not undergo any change in chemical structure" [8-10]. PANI has wide range of application due to its flexible properties in different area. Such some applications are solar cell, LED, sensors, radiation absorbers and electromagnetic shields. It is possible to alter the properties of the PANI by the process of doping metal oxide or various types of particles with polyaniline. The conductivity results in the polyaniline composite due to the redox behaviour. Hence so called polyaniline composite [11].The PANI/ **WO_3** 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 [12]. The current study (PANI) is select as a conduct polymers, **WO_3** used to make composites with PANI to tailor various electric and thermoelectric properties of PANI and its composites. Characterization of the conducting polymers / composites prepared was done to bring out the changes happening due to doping. Diverse characterization techniques working were FT-IR, XRD and SEM. study on convey properties such as DC, DC studies were completed for these conducting polymer composite.[13-14].

Materials and Methods:

Aniline, hydrochloric acid (HCL) and ammonium persulfate (NH4)2S2O8 of analytic grade are used for synthesis of polyaniline and manganese oxide was used to prepare composites via chemical oxidative polymerization method.

Preparation of Polyaniline (PANI) All the samples are prepared at room temperature (RT). Solution of aniline of about 0.2M was prepared and mixed with 1N of solution of hydrochloric acid at RT. The above aniline and HCL mixture was stirred for 3 hours using magnetic stirrer. Further the solution of ammonium persulfate (NH4)2S2O8 of about 0.25M was prepared and added to above mixture drop wise using pipette. Then the mixture is stirred for 8 hours at RT. The precipitate formed and separated out by filtering and washed with deionised water with acetone. The obtained final suspension was dried in oven at 50° C for 24 hrs. The final product was grinded into powder.

Preparation of PANI/ WO_3 composite: All the samples are prepared at room temperature (RT). Solution of aniline of about 0.2M was prepared and mixed with 1N of solution of hydrochloric acid at RT. The above aniline and HCL mixture was stirred for 3 hours using magnetic stirrer. Further the solution of ammonium persulfate (NH4)2S2O8 of about 0.25M was prepared and added to above mixture drop wise using pipette. **WO_3** powder for different additive weight percentage is dissolved in the mass fraction to the above solution with vigorous stirring in order to keep the **WO_3** homogeneously suspended in the

solution and stirring of final solution was continued for another 8 hours at room temperature. The precipitate formed and separated out by filtering and washed with deionised water with acetone. The obtained final suspension was dried in oven at 50° C for 24 hrs. The final product was grinded into powder

Results and Discussion

X-ray diffraction*:*

X-ray diffraction (XRD) is a central technique for the determination of the structure and composition of obtained composites. The XRD confirmation of the crystal phases of polyaniline (PANI) and PANI/WO3 composite samples depicted in figure 1 and 2 respectively. The broad diffraction peak was observed between diffracted angle 2θ ranges from 26^0-30^0 which is characteristic peak polyaniline suggests the amorphous nature of the prepared PANI. The broad diffraction peak with d spacing d=3.29 corresponds to the reflection (200) due to parallel and perpendicular periodicity of the polymer (PANI) and no extra diffraction peaks are observed. The composite pani XRD peaks shows crystalline nature [15].

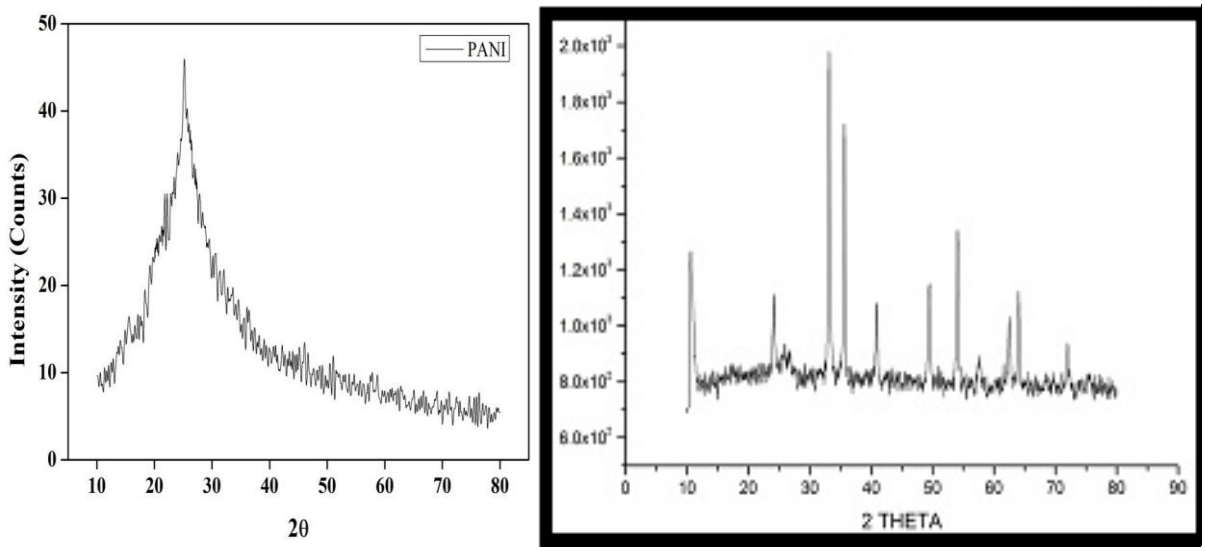


Fig: X-ray diffraction (XRD): (PANI) and PANI/WO3

SEM

PANI and PANI/ WO_3

Figure 3 displays the SEM picture of PANI/ WO_3 Nano composite and PANI/ WO_3Nano composite samples, respectively. Pure PANI image shows particles of almost spherical in nature with a close compact arrangement. The sample was of near-amorphous nature, and the particle sizes may be in the Nano-range. The SEM image PANI /WO_3Nano composite is given in Fig. 4 which shows irregularly formed elements and some elements are collected each other to form a crystalline nature. A growth in crystallinity in the PANI is due to the attendance of metal oxide, which may be experiential in the image. In continuation, the PANI/ WO_3 Nano composite sample image shows the fine particles with a spherical shape. Some particles show a globular arrangement with a close association as applicable morphology may be experiential for both the tasters, which may be due to a close mixture assembly of elements. [16]

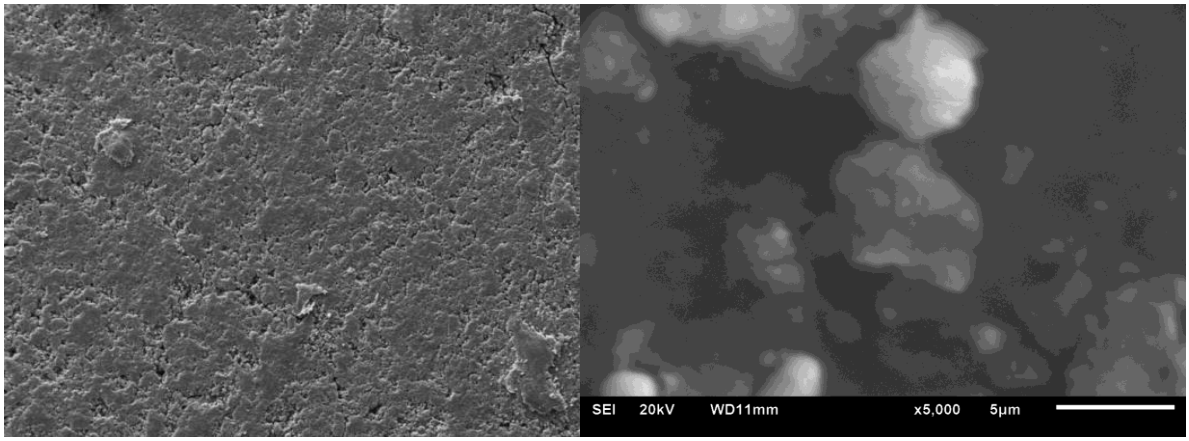
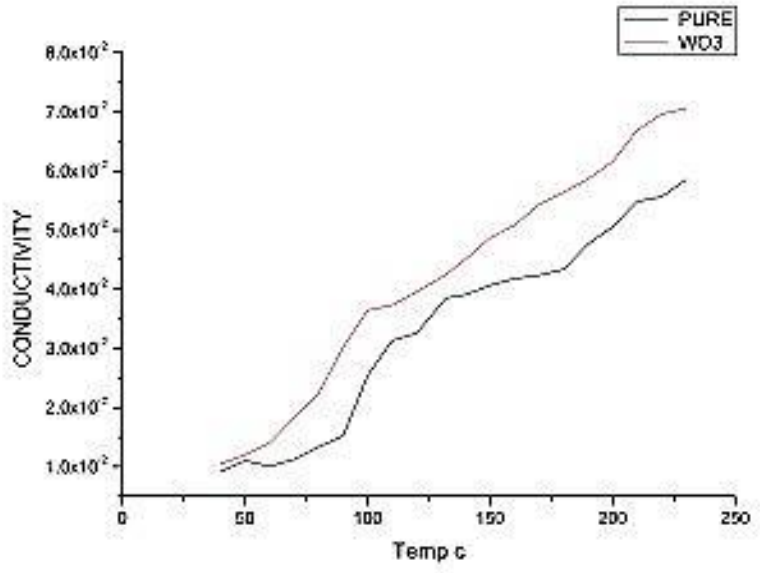


Fig: SEM picture of PANI/ WO_3

ELECTRICAL PROPERTIES - DC CONDUCTIVITY

PURE PANI AND Polyaniline – WO_3 composites

Fig shows the difference of DC conductivities as a role of hotness for PANI. The conductivities increasing with increases temp. Exhibits the conductivities 3 phase in a warmth i.e. from 40 ^{0}C to 200 ^{0}C. The steady in 40 – 100 ^{0}C, and increase slowly in the hotness series 100 – 180 ^{0}C. In stage III, 180 – 200 ^{0}C, a linear increase in the conductivities value is experiential. Fig 3 demonstrates the difference of dc conductivities as a role of temp for WO_3 in PANI. It is observes that the worth of DC conductivities of composite increasing exponential with temp. Constants up to 100^{0}C and there after it increases exponential the conductivity performance is the attribute of shapeless resources. The early decreasing conductivity value up to 20wt% of WO_3 in PANI may be due to blocking of charge carrier. However, it is found to increase for 25 wt% and is owing to comprehensive sequence lengths in which the charging carrier have enough energies to hoop b/w a variety of favourable localizes site. [17-19]



Fig; DC conductivities of PANI/ WO_3

Conclusion

The PANI and PANI/ WO_3 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/ WO_3 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 WO_3 had an effect on PANI morphology, and with increased WO_3 content, the composites showed a transformation in morphology from typical granular and nonporous PANI particles

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