International Journal of Scientific Research in Science and Technology
Print ISSN: 2395-6011 | Online ISSN: 2395-602X (www.ijsrst.com)
© 2021 | IJSRST | Volume 8 - Issue 1

Synthesis and Characteristics of MgO Doped Polyaniline Nano Composites

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ABSTRACT

In this paper, Magnesium oxide nano particles were prepared by sol-gel technique. In this synthesized using magnesium nitrate as a precursor. The PAni- MgO samples are prepared with 30 and 40 wt%. The structural changes of prepared composite materials were carried out by X-ray diffraction (XRD) tool.

Keyword:- PAni, MgO, XRD

I. INTRODUCTION

Conducting polymers have emerged as a very important class of materials because of their unique electrical, optical, and chemical properties leading to the wide range of technological applications. This class of materials provides tremendous scope for tuning of their electrical conductivity from semiconducting to metallic regime by way of doping [1, 2]. The unique properties of conducting polymers not only provide great scope for their applications but also have led to the development of new models to explain their observed properties, particularly various mechanisms of charge transport [3, 4].The importance of polymers is mainly because polymers are still regarded as a cheap alternative material that is manufactured easily. The intensive use of polymer in broad has led to the development of materials for specific applications namely composites [5]. Recently polymer matrix-ceramic filler composites receive increased attention due to their interesting electrical and electronic properties, integrated decoupling capacitors, angular acceleration accelerometers, acoustic emission sensors and electronic packaging. Ceramic materials are typically brittle, possess low dielectric strength and in many cases are different to be processed requiring high temperature. On the other hand, polymers are flexible, can be easily processed at low temperatures and exhibit high dielectric break down fields. Practical application of conducting polymers such as polypyrrole, polythiophene and polyaniline is limited particularly because of their poor mechanical properties.

Magnesium oxide can be used as a wood chips, sound-proof, light weight, heat- insulating and refractory fiber board and metallic ceramics. Also magnesium oxide applied in electronics, catalysis, ceramics, coatings and many other fields. Many researchers have discussed the synthesis and applications of magnesium oxide nano particles [6-11]. Magnesium oxide is also used as an additive in heavy fuel oils [12], reflecting and anti-reflecting coating [13] in optical applications and is used as the substrate in superconducting and ferroelectric thin films [14-16].

When size of MgO is reduced to Nano scale then properties of novel MgO are further magnified.

II. METHODS AND MATERIAL

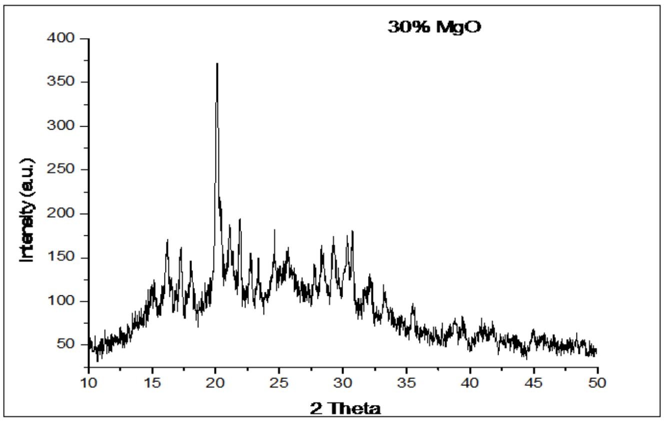
1.1. Synthesis of Polyaniline (PAni):

Project participants followed the same instruction to oxidize 0.2M aniline hydrochloride with 0.25 M ammonium peroxydisulfate in aqueous medium. Aniline hydrochloride (purum, 2.59g, 20 mmol) was dissolved in distilled water in a volumetric flask to 50 ml solution. Ammonium peroxydisulfate (purum, 5.71 g, 25 mmol) was dissolved in water to make 50ml solution. Both solutions were kept for 1 h. at room temperature (~ 291 -297^{O} K), then mixed in a beaker, briefly stirred, and left at rest to polymerize. Next day, the PAni precipitate was collected on a filter, washed with 100 ml portions of 0.2 M HCl and similarly with acetone. Polyaniline (emeraldine) hydrochloride powder was dried in air and then in vacuum at 60^{O}C.

1.2. Synthesis of Magnesium Oxide:

Magnesium oxide was prepared by sol-gel technique. These were synthesized using magnesium nitrate ($MgNO_3 6H_2O$) as a precursor. Firstly 0.2 M magnesium nitrate was mixed in 100 ml of de-ionized water. Thereafter 0.5 M sodium hydroxide solution was added to the magnesium nitrate solution drop wise with continuous stirring (30min). Appearance of white precipitate in the beaker shows the formation of magnesium hydroxide. The pH of the solution was 12.5, as measured by digital pH meter. Filtered precipitate washed with methanol is dried at room temperature. Washing with methanol removes ionic impurities. The dried white powder was annealed in air for one to two hours to obtain MgO powder.

III. RESULTS AND DISCUSSION



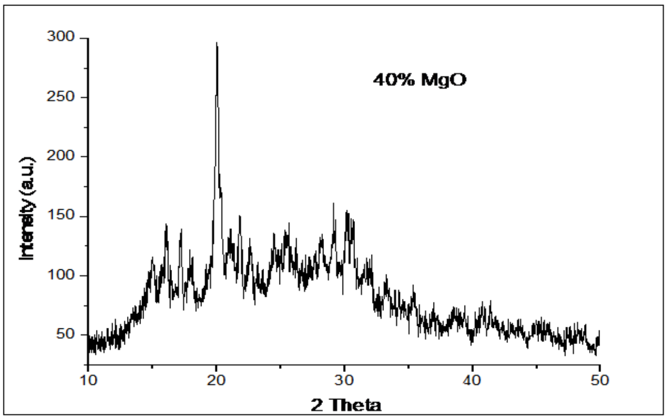


Fig.1(a)X-rd of 30 wt% MgO-PAni Nanocomposite
Fig.1(b)X-rd of 40wt% MgO-PAni Nanocomposite

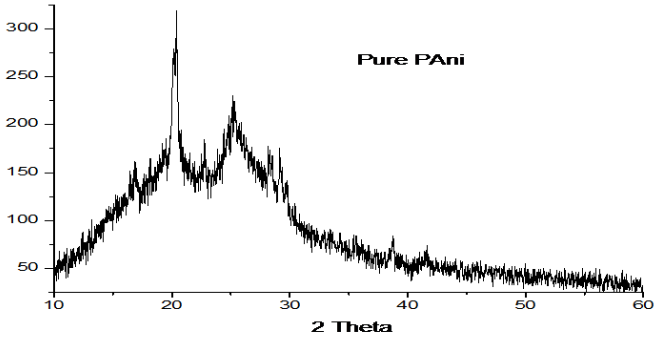


Fig. 1(c) X-rd of Pure Polyaniline

The X-ray diffraction patterns of the sample in the present study are obtained on Rigaku Miniflex-600 X-ray diffracto meter using Cukα radiation (λ = 1.5406 A°). The diffract grams were recorded in the terms of 2θ in the range of 10- 80° with a scanning rate of 15 per minute.

Fig. 1(a) and (b) shows XRD patterns of 30wt% MgO-PAni and 40wt% MgO- PAni nanocomposites were scrutinized to compute their crystallite size. The technique was used to examine the lattice constant, cell volume of the synthesized polyaniline and MgO-PAni nano composites. The X-ray diffraction pattern presents the peaks with the reference pattern of polyaniline and MgO which confirms the successful synthesis of the Nano composites with cubic structure. Fig. 1(c) shows the X-ray diffraction pattern of polyaniline . analysis of X-ray diffraction of polyaniline suggest that it has amorphous nature with broad peaks.

IV. CONCLUSION

The sol-gel method was used for preparation of PAni-MgO nano composites. This method may be used for the preparation of PAni nano composites with various metal oxide materials. Structure changes of pure PAni and PAni-MgO is observed by XRD pattern

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