POLYANILINE/CdO NANOCOMPOSITES IN POTENTIAL APPLICATIONS

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ABSTRCT:

The PANI/CdO nanocomposites were prepared by Self Propagation Low temperature combustion method using Cadmium nitrate. It is a simple and low-cost method to synthesis nanocomposite. The prepared samples were characterized by using Scanning Electron Microscope (SEM) and X-ray diffraction (XRD) to get surface morphology, idea of getting particles of Nano sized range so that further characterization can be done, to study the Dielectric Loss Behaviour properties of synthesized nanocomposites.

Key words: Metal Oxide nanoparticles, polyaniline, structural properties.

1.INTRUDUCTION:

Conducting polymers have many potential applications in many technological fields. Conducting polymers offered the promise of achieving a new generation of polymers which exhibits magnetic, mechanical, electrical, sensor and optical properties of metals and semiconductors. Among the family of polymers, Polyaniline (PANI) is unique due to low cost, good stability and easy synthesis. Recently conducting polymer-metal oxide nanocomposites have been considered as new class of materials due to their improved properties. CdO is n-type semiconductor used as transparent conductive material and this material used in applications such as Liquid Crystal Display (LCD), phototransistor, photodiodes, antireflection coat, IR detectors, etc.

In present work, we are introducing polyaniline in which nanoscale filler of CdO are embedded in the polymer matrix as a result it enhances its physical properties and novel behavior to the original polymer matrix. we observed that dielectric loss of polyaniline various the concentration percentages vary. In this paper we report XRD, SEM and Dielectric loss of Polyaniline/CdO nanocomposites.

2.EXPERIMENTAL:

Synthesis of CdO nanoparticles by Self Propagation low temperature combustion method using respective metal precursor cadmium Nitrate. Cadmium Nitrate was added slowly in 500 ml beaker with distilled water and the solution was stirred. While stirring, equimolar Oxalic acid in aqueous solution was added. Then stirring was carried for another two hours and the solution was kept overnight. Then the solution was filtered and precipitate of CdO powder was obtained which was mixed with polyethylene glycol 6000 in the ratio 1:5 and heated Nano powder CdO was obtained and finally it is several time washed with acetone and distilled water. Crystalline form of CdO was sintered up to 600ºC.

Synthesis of PANI -CdO nanocomposites PANI-CdO nanocomposite was obtained by in-situ polymerization. Initially polymerization of monomer aniline was initiated by drop wise addition of APS in acidic medium in which 10wt% to 50wt% of synthesized CdO powder was added. The stirring was continued for 6 hours under 0 to 5℃ and then the mixture was filtered, washed with distilled water and the acetone and then dried at 80ºC for overnight.

3. CHARACTERIZATION TECHNIQUES:

Wide angle x-ray diffraction X-ray diffraction (XRD) studies were carried out using a Philips powder X-ray diffractometer (Model: PW1710). The XRD patterns were recorded in the 2θ range of 10° - 80° with step width 0.02° and step time 1.25 sec using CuK α radiation (λ = 1.5406 Å). The XRD patterns were analyzed by matching the observed peaks with the standard pattern provided by JCPDS file. Scanning electron Microscope are recorded with help Hitachi SEM experiment

4.RESULT AND DISSCUSSION:

4.1 X Ray diffraction (XRD):

The XRD patterns of Pure polyaniline, pure CdO and PANI/CdO Nanocomposites (50wt%) are shown figures 1,2 and 3 respectively. The XRD pattern of pure polyaniline suggest that it has an amorphous in nature with board peak cantered on 2θ~ 25.53° which corresponds to (200) diffraction planes of pure PANI. The XRD pattern of pure CdO has been matched with standard JCPDS No.11049. According to this data, Structure of simple cubic where atoms are arranged in octahedral. The particle size of pure CdO was determined from width of XRD peak by using Debye Scherer's formula is given by D=0.89 λ/β Cosθ where β is Full width at half Maxima(FWHM). and it was found to be 45nm. The XRD pattern of PANI/CdO nanocomposites shows semi crystalline nature and it is confirmed that CdO has retained its structurer even though it is dispersed in PANI during polymerization reaction.

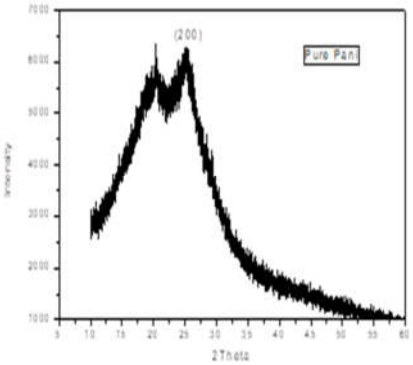

Fig. 1XRD pattern of Pure Polyaniline

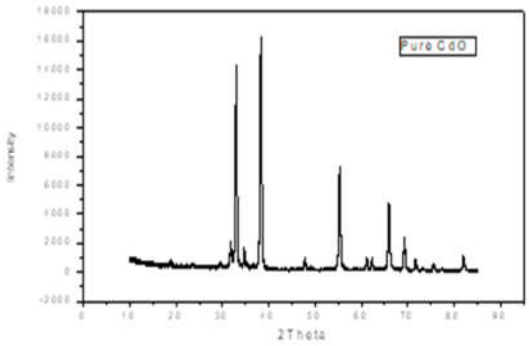

Fig. 2 XRD pattern of Pure CdO

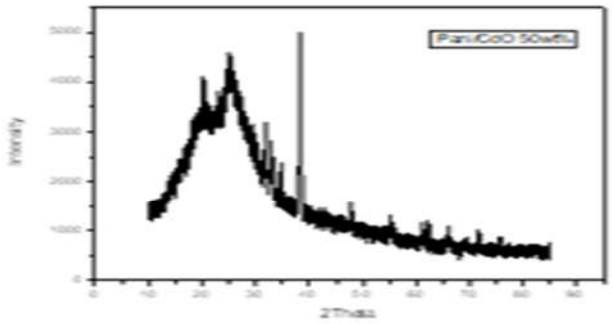

Fig. 3XRD pattern of Polyaniline/CdO 50wt% Nanocomposite.

4.2 SCANNING ELECTRON MICROSCOPE (SEM):

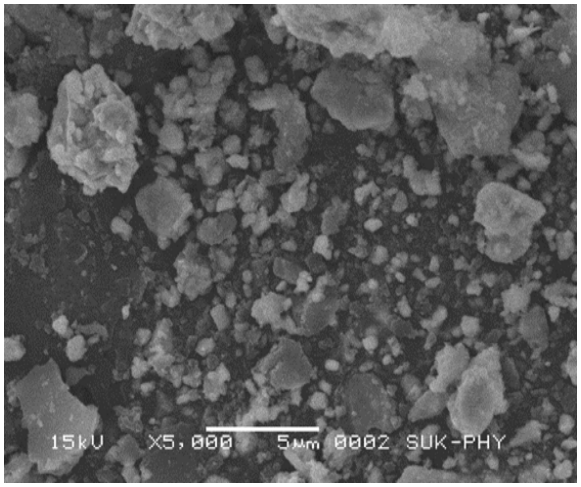

Fig.4 SEM Image of Pure CdO

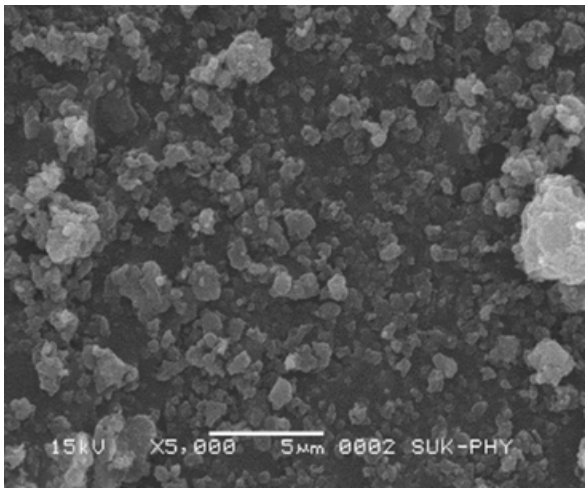

Fig.5 SEM Image of PANI/CdO 50wt%

Scanning Electron Microscopy Morphological study of doped PANI- CdO nanocomposite was carried out using scanning electron microscope. The SEM image of PANI/Cdo Nanocomposites (50wt%) is as shown fig.5. it can see from the image that the particle size is in the range of nanometer and having irregular shape and separate with each other.

4.3 DIELECTRIC LOSS:

The variation of dielectric loss as a function of frequency for different wt. % of polyaniline – Cadmium oxide composites at room temperature is represented in Figure 6. Even though PANI/CdO Nano composites are added 10 wt% and 20 wt% shows Dielectric loss decreases and at higher frequencies these two exhibits zero dielectric loss and 30wt%,40wt%,50wt% and pure polyaniline shows zero dielectric loss for higher frequencies which suggests that these composites are loss less martials at frequencies beyond 7kHz.

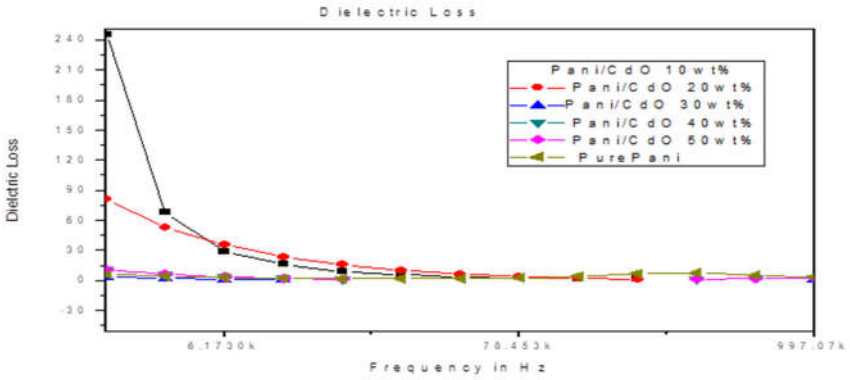

Fig 6. Dielectric Loss of PANI/CdO

5.CONCLUSION:

CdO nanoparticles were synthesized by self-propagating low temperature combustion method. A series of PANI/CdO nanocomposites have been synthesized by chemical oxidation polymerization method. The XRD pattern of PANI/CdO Nanocomposite of 50wt% shows semi crystalline nature. The dielectric loss of composites from 10wt% to 50wt% with pure polyaniline shows as weight percentages and frequencies of the above sample increases dielectric loss will be decreased and becomes zero therefore these composites are used in potential application of battery.

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