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PREPARATION AND CHARACTERIZATION OF CdO/PVP NANOPARTICLES BY PRECIPITATION METHOD

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ABSTRACT

Cadmium Oxide/ Poly vinylpyrrolidone Nanocomposites has been was prepared using modified precipitation method using cadmium chloride and ethanol solution. The particle size of CdO/PVA nanoparticles is found to be 44 nm using X-ray diffratometer. UV visible found absorption peak appeared at 297 nm. This absorption band of CdO/ PVA nanoparticles has been shows a blue shift due to quantum confinement. Photoluminescence (PL) spectrum shows band edge emission at 396 nm and green emission at 548 nm. Green emissions arise from the oxygen vacancy of CdO material because of photo generated hole in valance band with an electron in conduction band.

Keywords: Cadmium oxide nanoparticles, UV, XRD, FTIR & PL

1. INTRODUCTION

The synthesis of binary chalcogenides of group II-VI semiconductor in a nanopowder form has been a rapidly growing area of research due to their important optical, physical and chemical properties. These II-VI semiconductor nanoparticles are presently of great interest for their physical applications such as zero dimensional quantum confined materials and for their applications in optoelectronics13. Semiconductor nanoparticles belong to state of matter in the transition region between molecules and solids12.The physical and chemical properties of these nanomaterials are found to be size dependent. Large scale synthesis of semiconductor nanoparticles such as solid powder is critically important not only for the study of their physical properties but also for industrial applications in the area of catalysis, photocatalysis and microelectronics10.Cadmium oxide is attracting tremendous attention due to its interesting properties like direct band gap of2.3 eV. It is widely used in the applications like the preparation of cadmium-coated baths and Manufacture of paint pigments. In the present paper, synthesis and characterization of cadmium oxide and cadmium sulphide nano-particles has been studied.

2. MATERIALS AND METHODS

2.1 Experimental Description

To prepare CdO/PVP Nanocomposites by taking 0.3g of Cadmium Chloride and 1g of PVA (Polyvinyl proponol) which was dissolved in 50ml of ethanol and the solution is stirred for 2 hours at room temperature. After the stirring process, sodium hydroxide solution was added to the solution to maintain the pH 10 and stirred for half an hour.

Subsequently, the solution was kept for 5 hours for the deposition of the CdO/PVP Nanocomposites. The particles were collected in a petty dish as a white precipitate subsequently the materials were dried at 80°C for 2hrs.The Brownish CdO/PVP Nanocomposites are collected. Finally the nanocomposites were grained and preserved in an air tight container. The same procedure is followed for 0.5g and 1g respectively.

3. RESULT AND DISCUSSION:

3.1. X RAY DIFFRACTION STRUCTURAL ANALYSIS

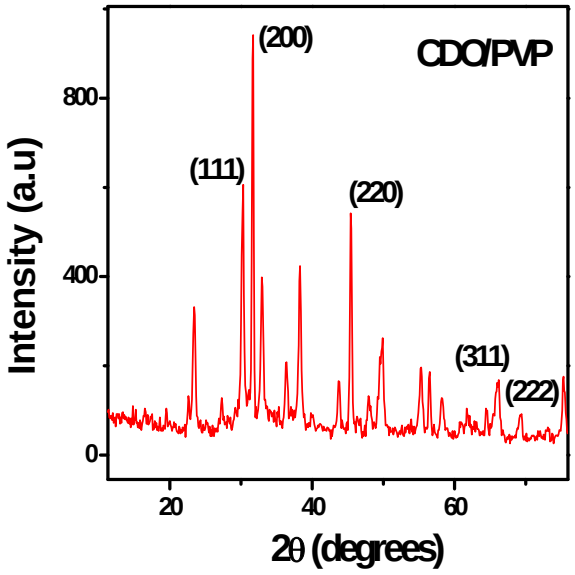

Figure 3.1 shows the XRD for Cdo/PVP Nanocomposites

The XRD pattern Fig. 3.1 for PVP-CdO Nanoparticles, the diffraction peaks are absorbed at 2Θ values. The prominent peaks have been utilized to estimate the grain size of sample with the help of Scherrer equation. The grain size estimated using the relative intensity peak (100) for CdO Nanoparticles was found to be 44 nm and increase in sharpness of XRD peaks indicates that particles are in crystalline nature. The (111), (200), (220), (311) and (222) reflections are clearly seen and closely match the reference patterns for CdO (Joint Committee for Powder Diffraction Studies **(JCPDS) File No. 05-0640).**

3.2 UV VISIBLE SPECTROSCOPY

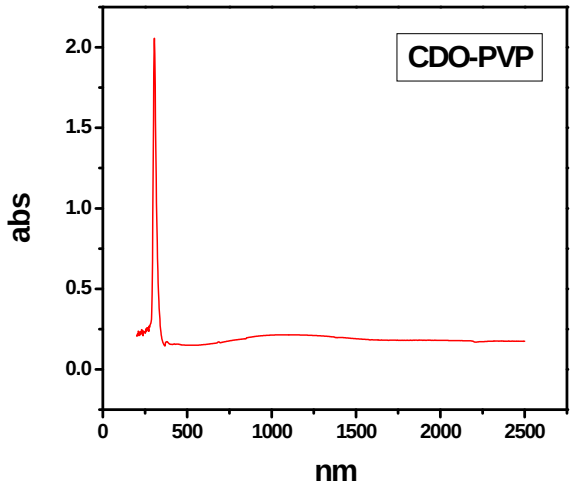

Figure 3.2 shows an absorption peak for CdO/PVP Nanocomposites

The UV–visible absorption spectra of CdO-PVP Nanoparticles are shown in Fig.5.2 although the wavelength of our spectrometer is limited by the light source, the absorption band of the CdO Nanoparticles have been shows a blue shift due to the quantum confinement of the exciton present in the sample compare with bulk CdO particles. This optical phenomenon indicates that these Nanoparticles show the quantum size effect. The maximum absorption peak appeared

at around 297 nm and its band gap value is around 4.18 eV. Here formation Nanoparticle is depend on surfactant and organic solvent because surfactant PVP helps to bind to the surface of the synthesized Nanoparticles, thus acting as particle stabilizer and tuning the nucleation/growth of particles to achieve a higher degree of uniformity.

3.3 FTIR SPECTROSCOPY

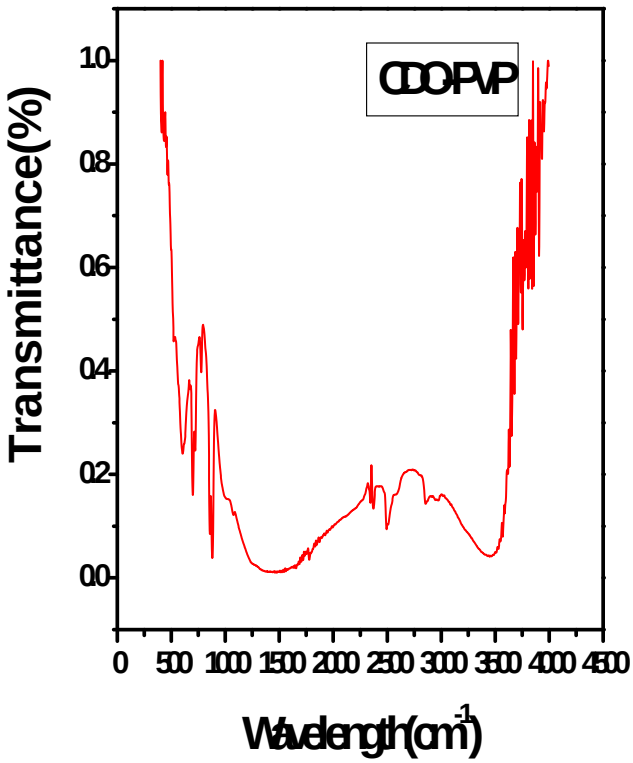

Figure 3.3 shows the transmittance for Cdo/PVP Nanocomposites

FTIR spectrum of CdO Nanoparticles is shown in Fig 3.3.There are O-H, C-H, C-C functional groups in addition to Cd-O bond. Such extra functional groups are due to incorporation of PVP which act as capping. Agglomeration among particles is hindered due to capping. The other O-H bond can interact with methanol or ethanol (organic solvent) through H bonding. A broad peak at 3500 cm-1 indicates that the H bonding is present in CdO Nanoparticles because capping.

3.4 PHOTOLUMINESCENCE

The room temperature Photoluminescence spectra of CdO/PVP Nanocomposites calcined at 80ºC are shown in figure 3.4

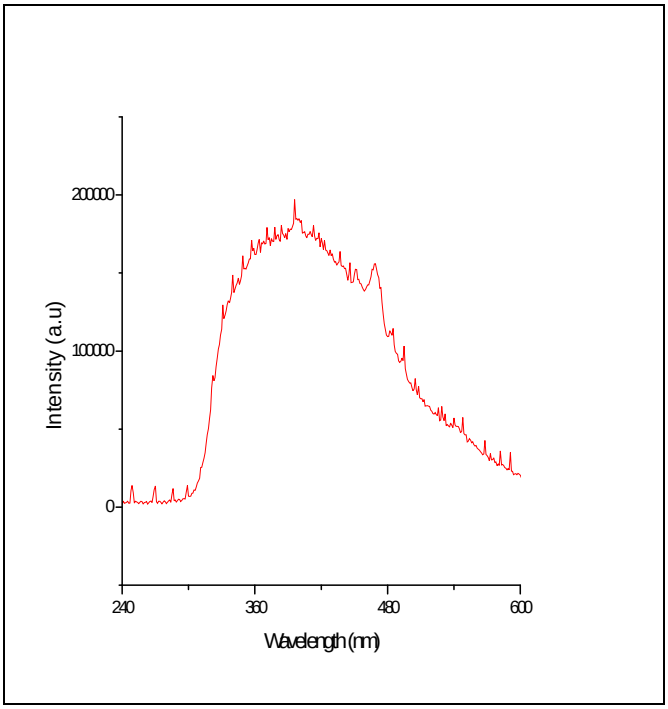

Figure 3.4 shows PL spectra for CdO/PVP Nanocomposites

A broad and maximum emission peak appeared at around 400 nm and its band gap value is around 3.1 eV. The peak at 396nm corresponds to the band edge emission. The peak at 468nm is due to artifact. The peak at 548nm arises from the oxygen vacancy of CdO materials because of recombination of a Photo generated hole in valence band with an electron in conduction Band.

4. CONCLUSION

The Cadmium Oxide/Polyvinylpyrolidine Nanocomposites were synthesized by using Modified Precipitation Method. The preparation has been done by using different concentrations. After synthesizing, It is possible to analyze the Nanocomposites using X-Ray Diffraction, UV Visible Spectroscopy, Fourier Transform Infrared Spectroscopy and Photoluminescence. XRD used to find the Nanocomposites Structure and the particle size and it is about 44nm. UV-VIS used to find the band gap energy and it is 4.18 eV and absorption peak around 297nm. FTIR used to find the functional groups present in the Nanocomposites. PL (Photoluminescence) used to study the Optical property.

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