

# Synopsis

The main objective of this thesis is to highlight the state of knowledge in synthesis, characterization, different properties, and potential applications for different heterostructured nanocomposite materials. Structural, chemical and morphological details of these nanocomposites have been studied. This work describes some possible applications of CdS/ZnO(three system), Co<sub>3</sub>O<sub>4</sub>/ZnO nanocomposites having different morphology.

In chapter 1, basic introductory discussion on nanostructured materials considering the origin of different properties that distinctively differs from their bulk components has been put forward. Some novel properties of as synthesized nanocomposites like optical, magnetic, photocatalytic and antibacterial properties are also discussed and have been reviewed.

Chapter 2 highlights chemical synthesis routes for CdS/ZnO(three system), Co<sub>3</sub>O<sub>4</sub>/ZnO, nanocomposites as well as how to engineer morphological variation in that nanophase system by simple technique. This chapter also includes structural, Chemical, optical and Morphological study of the nanocomposites extensively.

Chapter 3 presents the photocatalytic property of as synthesized nano composites. The visible-light photocatalytic activity of CdS-ZnO1:1, CdS-ZnO1:2, CdS-ZnO1:3 and Co<sub>3</sub>O<sub>4</sub>-ZnO samples was carried out by using it to degrade rhodamine B dye aqueous solution. To address the photocatalytic effect in details a possible charge transfer mechanism in our synthesized system is proposed as a modified energy band diagram.

In Chapter 4, study of magnetic behaviour of Co<sub>3</sub>O<sub>4</sub>-ZnO is presented. The *M-T* and *M-H* variation of prepared Co<sub>3</sub>O<sub>4</sub>-ZnO nanocomposite are studied. The blocking temperature (*T<sub>B</sub>*) for the Co<sub>3</sub>O<sub>4</sub>-ZnO nanocomposite, the signature of *T<sub>B</sub>* has been observed at nearly 33K.

The most interesting observation for the  $\text{Co}_3\text{O}_4\text{-ZnO}$  nanocomposite sample is that, nearly at 15K both  $M_{\text{ZFC}}$  and  $M_{\text{FC}}$  data start to increase rapidly.

Chapter 5 demonstrates the antibacterial activity of as prepared nanocomposites. Investigation showed that CdS-ZnO nanocomposites showed larger inhibition zones against *Staphylococcus sp* than *Escherichia coli* and *Klebsiella sp* and demonstrates the potential application of CdS/ZnO nanocomposites as an effective antibacterial agent against *Staphylococcus sp*, *Escherichia coli* and *Klebsiella sp*.

Chapter 6 includes the conclusion and future work proposals. The work can be continued in different directions such as synthesis and study of  $\text{Fe}_2\text{O}_3/\text{ZnO}$ , RGO/metal oxide nanocomposites, antibacterial property and water splitting by different nanocomposites etc.