Direct Thermal Decomposition of $[Cd(DADMBTZ)_3](ClO_3)_2$ Complex for the Synthesis of CdO-CdS nanocomposite

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Recently, much effort has been devoted to the design and controlled fabrication of nanostructured materials with functional properties. Among these investigations, the nanocomposite materials can not only demonstrate small size effect, surface effect, and quantum–dimension effect, but also combine the advantages of all ingredients. Therefore, the nanocomposite materials have attracted more and more attention due to their tailored properties and potential application in photonic crystal, drug delivery, biological markers, bio-separation, and as catalyst. Various kinds of nanocomposite materials have been successfully fabricated such as metal/metal, metal/semiconductor, semiconductor/semiconductor, inorganic particle/polymer and inorganic particle/inorganic particle, showing tailored magnetic optical electrical properties [1, 2]. CdS, an important semiconductor with a wide band gap of 2.4 eV at room temperature. It has high potential application in light-emitting diodes, solar cells, optoelectronics and catalysts [3]. There are a variety of methods used to prepare this material. Changes in the photoactivity of CdS can also be achieved by combining the CdS semiconductor with other semiconductors at different energy levels (ZnS, ZnO, TiO_2…). Modification of CdS by impurity can efficiently adjust its electrical, optical, and magnetic properties. In spite of the absence of studies in literature on the effect of CdO presence on the activity of CdS under visible light, there are interesting results showing the increase in CdS activity for samples mixed with CdO [4,5].

The potential use of supramolecular coordination complexes as materials for nanotechnological applications would seem to be very extensive as nanometer- scaled materials often exhibit the new interesting size-dependent physical and chemical properties that cannot be observed in their bulk analogous. The use of bithiazole complexes as precursors for preparing inorganic nano-materials has not yet been investigated thoroughly [6].

The tris-chelate Cd(II) complex, $[Cd(DADMBTZ)_3](ClO_3)_2$, DADMBTZ=2,2'-diamino-5,5'-dimethyl-4,4'-bithiazole, has been synthesized by reaction of $Cd(CH_3COO)_2$ with DADMBTZ in 1:2 ratio in the presence of an excess amount of potassium chlorate. The complex was characterized by elemental analyses and IR, ^1H, ^{13}C NMR, ^{113}Cd NMR spectroscopy. The thermal behavior of compound $[Cd(DADMBTZ)_3](ClO_3)_2$ was studied by thermal gravimetric and differential thermal analyses. The nanocomposite CdO-CdS has been prepared by direct thermal decomposition of $[Cd(DADMBTZ)_3](ClO_3)_2$. The nanocomposite was characterized by scanning electron microscopy, X-ray powder diffraction (XRD), and IR Spectroscopy. Estimated from the Scherrer formula, the average size of the particles is about 43 nm for CdO-CdS nanocomposite after calcination of compound $[Cd(DADMBTZ)_3](ClO_3)_2$ in agreement with that observed from SEM images.

References

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Figures

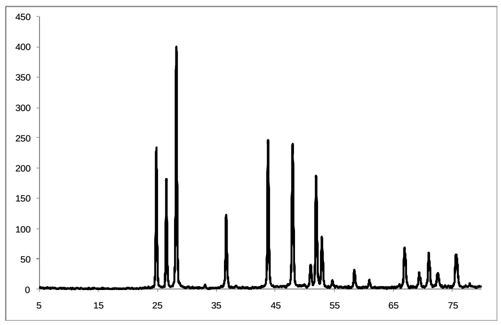

Fig.1. XRD pattern of CdO-CdS nanocomposite

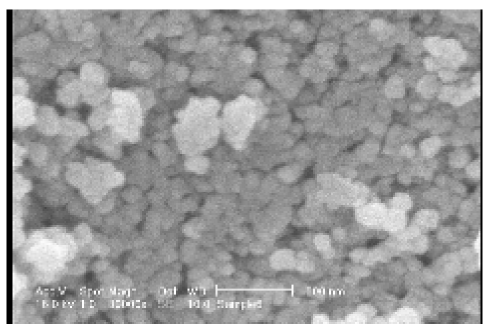

Fig.2. SEM image of CdO-CdS nanocomposite