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Heat-up approach of inorganic aliphatic Co(II) complexes to form CoS quantum dots for quantum dots sensitized solar cells

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Nanoscience research has shown a drastic increase in metal nanoparticles in various fields compared to their corresponding Group V and VI counterparts. This can be attributed to their unique properties, easy to harness, high surface atoms, which promote better active sites with unique electronic properties between the metallic and molecular states. Specifically, metal sulfides have a variety of sulfur-containing ligands that are easily tunable and can have their decomposition kinetics and secondary decomposition products optimized by controlled modification using precursors like dithiocarbamates (DTCs). Extensive studies are yet to be conducted on cobalt sulfide (CoS) to explore the strong coexistence of reducible cobalt with oxidizable sulfur ions as compared to other metal sulfide semiconducting materials. In the present study, we demonstrated the intriguing structural, optical, and morphological properties of CoS quantum dots for dye-sensitized solar cells (DSCs). The photosensitizers were characterized by TGA, FTIR, SEM, EDS, TEM, UV-Vis, and PL. The X-ray diffraction pattern for the prepared CoS@a, CoS@b, and CoS@c nanoparticles matched well with the hexagonal and cubic phases of CoS and CoS2. The energy band gap of 1.7–2.3 eV for the three samples implies that these materials are better candidates for QDSSCs and energy storage device applications. This is further supported by SEM analysis for CoS@a and CoS@c with nano-rod micrographs, which are known as catalysts for enhancing electrical conductivity. The thermolysis of the three molecular precursors using a single-source approach below the boiling point of the coordinating solvent produces CoS without impurity. We believe that the fascinating macro/nanostructure obtained in this study can be explored in different applications, such as QDSSCs.

Apply to be considered for a student ; award (Yes / No)?

No

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N/A

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