Abstract

The thesis provides indepth information about the recent progress in synthetic strategy and growth mechanism for obtaining nanostructured materials. The usage of the as synthesized materials in photocatalysis and as supercapacitor is also discussed in detail. The first chapter describes the background information about nanomaterials and some mechanistic aspects of photocatalysis and supercapacitance. The second chapter describes the shape selective synthesis of SnS_2 nanomaterials adopting modified hydrothermal (MHT) protocol and their capability towards the reduction of toxic Cr(VI) under visible light irradiation. It was observed that SnS_2 nanoflowers stands superior to nanoyarns towards the reduction of Cr(VI) and the reasons has been underlined. The third chapter embodies an inexpensive, simple wet chemical route to synthesis of cubooctahedron $Zn_3V_2O_8$ from zinc sulfate and ammonium vanadate. The synthesized material exhibits enhanced photocatalytic activity under UV light exposure. Fourth chapter reports fabrication of CuS/ZnS composite out of the reaction of preformed ZnS nanoflower with aq. $CuSO_4$ at room temperature. The as-synthesized composite has been found to bear heterojunction which becomes unique in driving visible light photocatalysis. Thus degradation of cationic dyes prompted in minimum time scale i.e., in 120 s. Fifth chapter describes a straight forward methodology for the morphology controlled synthesis of 3D $Co(OH)_2$ nanomaterials at room temperature. The as-prepared nanomaterial exhibits a higher specific capacitance with excellent cycling stability. Sixth chapter describes a simple, cost-effective synthetic route to immobilize $Co(OH)_2$ that way functionalize multiwalled carbon nanotubes (MWCNTs). Because of the combination of the pseudocapacitive $Co(OH)_2$ nanoparticles and the EDLC MWCNTs, the MWCNT/$Co(OH)_2$ electrode exhibits very high specific capacitance of 603 F g^{-1} at 1 mV/s scan rate and tremendous cycling stability. Seventh chapter demonstrates a facile, one-pot synthesis of fine Mn_3O_4 functionalized on MWCNTs. The composite with 8.5 wt% MWCNT/Mn_3O_4 was found to be superior to bare Mn_3O_4. On the other hand 4.1 wt%, 12.2 wt% analogues of MWCNT/Mn_3O_4 exhibit high specific capacitance of 441 F g^{-1} at 2 mV s^{-1}.

Keywords: *Nanostructured materials, Morphology, Synthesis, Photocatalysis, Supercapacitor, Multiwalled carbon nanotube, Cyclic voltammetry, cycling stability, Catalyst, Visible light.*