Abstract

Nanoparticles have a high surface area and enhanced optoelectronic properties which make them advantageous over bulk materials in terms of cost, processing, and advanced applications. Metal oxide nanoparticles, such as ZnO, are an example of versatile nanomaterial that is used in a wide range of energy applications, including solar cells, organic field-effect transistors, sensors, and photo/electrochemical cells. By use of nanotechnology, tetra metal composites are fabricated by the Co-Precipitation method and other Nanomaterial's synthesis methods. Different transition metals (Ni, Sn, Cu, Gd, Cr) doped with ZnO are prepared to enhance the photocatalytic ability of zinc oxide nanoparticles. To study structural and optical properties of the tetra-metallic composites, XRD, particle size analyses, UV-Visible spectroscopy, and Photoluminescence spectroscopy are performed. To study structural and optical properties of the tetra-metallic composites XRD, Particle size analysis, UV-Visible spectroscopy, and Photoluminescence spectroscopy has been conducted. The XRD shows the highest peak at angle 36.27° and the grain size is 16 nm. The bandgap of Cu, Ni, Sn doped ZnO became decrease as compared to ZnO because it shifted the wavelength from 360 nm to 380 nm in UV spectroscopy. The PL data shows orange-red color emission at 750nm with an excitation wavelength of 720 nm. The methyl blue dye was used for the degradation application, to evaluate the efficiency of tetra-metallic composites. The efficiency in the solar cell was high because it degrades within 4 minutes when compared with room and UV light degrades in 6 min. Reduction of the 2-nitrophenol to 2-aminophenol by using the metallic Tri-Metallic and Tetra Metallic catalyst.