Effect of Surface Morphology of Hydrothermally Synthesized Nickel Ferrite Magnetic Nanoparticles on Photocatalytic Water Remediation

Deepak Kumar Dinkar [1, 2], Brijnandan Singh Dehiya [2]

[1]*Centre for Automotive Energy Materials, International Advanced Research Centre for Powder Metallurgy and New Materials, IIT Madras Research Park, Chennai, India*

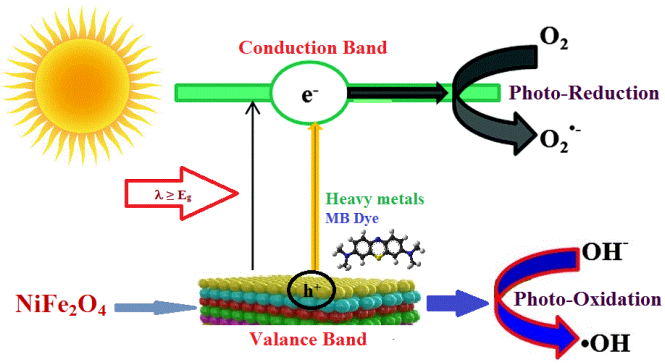
[2]*Nanostructure Materials Laboratory, Department of Materials Science & Nanotechnology, Deenbandhu Chhotu Ram University of Science & Technology, Sonepat, India*

E-mail: mail.dkdinkar@gmail.com

Abstract

Many research studies have been reported in the last decade on the significant utility of nanoferrites in waste water treatment. AB_2O_4 spinel, and spinel-like nanoferrites (with A=Divalent and B=Trivalent transition metal cations) are of great interest for applications in various fields due to their unique physics and chemistry and our ability to control the spectrum of properties by various processing techniques. The great advantage of nanoferrites in waste water treatment is their physical seperability (phase separation) using an external magnetic field which facilitates reuse. In this study, $NiFe_2O_4$ nano-ferrites have been synthesized by a hydrothermal treatment method. The material was characterized by x-ray diffraction, field emission scanning electron microscope and vibrating sample magnetometer studies. Two different morphologies, spherical and octahedral have been found in the synthesized samples with varying surfactant concentrations. These ferrites are photo-catalytically active even in the visible range of the solar spectrum. The effect of different morphologies on the photo-catalysis has been studied. The saturation magnetization and coercivity are also important parameters in addition to the optical band gap of nanoferrites for their usage in waste water remediation. The different structures, protocols and characterization parameters are analysed and compared to extract discernible patterns.

Graphical Abstract:



Keywords: Surface morphology, Nickel ferrite, Water remediation, Band gap, Magnetic Nanoparticles