THE OPTICAL PROPERTIES OF MANGANESE DOPED TIN OXIDE SYNTHESIZED BY MECHANOCHEMICAL PROCESSING

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ABSTRACT

THE OPTICAL PROPERTIES OF MANGANESE DOPED TIN OXIDE SYNTHESIZED BY MECHANOCHEMICAL PROCESSING

Pure and transition metal ion (Mn) doped SnO2 nanoparticles were synthesized using a simple mechanochemical method. Transition metal ions (Mn) concentration of 0.00, 0.02, 0.04, 0.06, 0.08, 0.10 were doped in order to study the influence optical properties. The optical properties of the samples were analyzed using X-ray diffraction (XRD), ultraviolet visible spectroscopy (UV-VIS), and photoluminescence (PL) techniques. The SnO2 crystallites were found to exhibit tetragonal rutile structure with lattice parameters, revealing that the metal ions get substituted in the SnO2 lattice. It is observed that the peak position (1 1 0) get shifted to higher angles by increasing the dopant concentration. Hence the lattice parameters (a and c) and the cell volume get decreased due to the ionic radius of Mn is lower than the ionic radius of Sn. A significant blue shift in the UV absorbing band edge was observed with the increase in the amount of the Mn and Co contents. The photoluminescence spectra are measured at room temperature as a function of different Mn2 concentration, respectively. The luminescence processes are associated with oxygen vacancies in the host and related with the recombination of electrons in singly occupied oxygen vacancies with photoexcited holes in the valence band.

CHAPTER 1

INTRODUCTION

1.1 Background and Problem Statement

Nanomaterials is a field that takes a materials science-based approach to nanotechnology. It studies materials with morphological features on the nanoscale, and especially those that have special properties stemming from their nanoscale dimensions. Nanoscale is usually defined as smaller than a one tenth of a micrometer in at least one dimension, though this term is sometimes also used for materials smaller than one micrometer. When nanometer size range is reached, it will alter the mechanical properties, optical properties and will make new quantum mechanical effect. For example, the quantum size effect where the electronic properties of solids are altered with great reductions in particle size. However, nanometer sized cannot see by human being due to its smallest size. Its must used certain equipment to obtain nanomaterial structure. A certain number of physical properties also alter with the change from macroscopic systems.