A.V.V.M. Sri Pushpam College (Autonomous)
Poondi– 613 503, Thanjavur-Dt, Tamilnadu
(Affiliated to Bharathidasan University, Tiruchirappalli – 620 024)

3.7.1 Number of Collaborative activities per year for research/ faculty exchange/ student exchange/ internship/ on –the-job training/ project work

Collaborating Agency:

Dr. A. T. Ravichandran Associate Professor

National College(Autonomous), Tiruchirapalli.

Dr. K. RAVICHANDRAN
Associate Professor & Head
Materials Science Research Laboratory
PG &Research Department of Physics
AVVM Sri Pushpam College (Autonomous)
Poondi-613 503, Thanjavur-Dt, Tamil Nadu, India.

Email :kkr1365@yahoo.com, kkravi1365@gmail.com, Phone : +91 9443524180

Date: 25.07.2017

LINKAGE

For the year 2017-2018

Between

1. Dr. K. Ravichandran
Associate Professor & Head
PG & Research Department of Physics
A.V.V.M Sri Pushpam College
(Autonomous), Poondi – 613 503.

&

2. Dr. A. T. Ravichandran
Associate Professor
PG & Research Department of Physics
National College (Autonomous)
Tiruchirapalli – 620 001,

Considering the significance of the noble cause for the student community, we have come forward to collaborate with each other to exchange research knowledge, expertise, laboratory and library facilities to the process of scientific research and education in the field of materials science. The parties (mentioned above as 1. & 2.) have had preliminary discussion in this matter and have ascertained areas of broad consensus. The parties now therefore agreed to enter in writing these avenues of consensus, under a flexible linkage, and this project aims to fill the gap between knowledge demand and subject expertise related to the mentioned field.

Joint Responsibilities

- Sharing of laboratory facilities, library resources, database etc.,
- Joint Publication of research articles, books, magazines, bulletins etc.,
- Jointly organizing conferences, seminars, symposia and workshops.
- Submitting joint proposals for research funding from agencies like UGC, CSIR, DST and TNSCST.

Dr. K. Ravichandran
HEAD,
PG and Research Department of Physics,
AVVM Sri Pushpam College (Autonomous),
POONDI, Thanjavur- 613 503.
Mobile : 94425 94621.

Dr. A. T. Ravichandran
Dr. A.T. RAVICHANDRAN, Ph.D.,
Associate Professor
PG & Research Department of Physics
National College (Autonomous)
Tiruchirappalli 620 001.

Journal of Materials Science: Materials in Electronics
https://doi.org/10.1007/s10854-017-8206-6

Revealing the influence of the Bi dopant on the structural, photoluminescence and antibacterial properties of ZnO nanoparticles

A. T. Ravichandran[1] · R. Karthick[1] · K. Ravichandran[2] · D. Ravinder[3] · R. Chandramohan[4]

Received: 21 September 2017 / Accepted: 6 November 2017

Abstract

Undoped and Bi doped zinc oxide nanoparticles were synthesized by soft chemical method. The effects of doping on structural and optical properties of Bi doped nanoparticles were investigated. The product was subjected to powder X-ray diffraction, field emission scanning electron microscope, transmission electron microscope and photoluminescence techniques. The crystallite sizes of synthesized samples were calculated from the powder XRD patterns, the crystalline size is variable from 42 to 56 nm for undoped and Bi doped ZnO nanoparticles respectively. The photoluminescence intensity of the Bi (7 at.%) doped ZnO was much higher than that of undoped ZnO nanoparticles. The undoped and Bi doped ZnO nanoparticles are subjected to antibacterial bio activity against both *Staphylococcus aureus* and *Escherichia coli* bacteria in order to find the materials efficiency towards the bacterial strains and it is found that there is a good zone of inhibition.

1 Introduction

Nanostructured ZnO particles are very much attractive for several applications in both microelectronic and optoelectronic devices. It has a wideband gap oxide semiconductor with a direct energy gap 3.37 eV, making it attractive nanoelectronic and photonic applications. Therefore, ZnO absorbs UV radiation due to band-to-band transitions. It can be used as transparent conductive oxide (TCO) materials, mainly for applications such as gas sensing, liquid crystal displays and photovoltaics [1, 2]. ZnO is also low-cost, plentiful in the nature and non toxic. Zinc oxide (ZnO) nanoparticles have been demonstrated to have enormous applications like as solar cells, transparent conducting electrode in photovoltaic, gas sensor, acoustic wave devices and laser diodes [3–9]. The semiconductor and optical properties of ZnO are extremely energy harvesting like photo thermal conversion system, gas sensor, and optical position sensors. ZnO is good candidates for solar energy conversion materials [10–13]. A number of investigations on the synthesized a variety of ZnO nanoparticles, including hydrothermal method [14], combustion synthesis technique [15], microwave synthesis [16], wet chemical method [17] and simple soft chemical route [18, 19]. Low temperature solution simple soft chemical route has high potential, simple, cost effective and energy saving route [20–22]. ZnO has been enhancing its properties with suitable doping material for a variety of optoelectronic devices. Doped ZnO nanoparticles have been attracted much attention because their inevitable role in transparent conducting electrodes (III B elements) and ferroelectric (Li, Bi or Mg) in optoelectronic devices. Bismuth has been an important impurity in ZnO is a good candidate as efficient applications due to much bigger radius of Bi^{3+} (0.103 nm) than that of Zn^{2+} (0.072 nm) producing the large mismatch in the lattice [23]. It can be used to favor trapping of photogenerated electrons, reducing the rate of recombination processes between electrons and holes [24, 25].

In this work, undoped and Bi doped ZnO nanoparticles were synthesized by simple soft chemical route. Even though, to our best knowledge, there are few reports of Bi doped ZnO nanoparticles, the study of the combined structural, photoluminescence and antibacterial properties of Bi doped ZnO is not so far. In this present work the structural, optical, morphological and antibacterial activities of Bi

R. Karthick
starkarthi6@gmail.com

1 PG & Research Department of Physics, National College, Tiruchirappalli 620001, India

2 PG & Research Department of Physics, AVVM Sri Pushpam College, Poondi 613503, India

3 Department of Physics, Osmania University, Hyderabad 540001, India

4 PG & Research Department of Physics, Sree Sevugan Annamalai College, Devakkottai 630303, India

Published online: 13 November 2017

Journal of Materials Science: Materials in Electronics
https://doi.org/10.1007/s10854-018-8966-7

CrossMark

Enhancing the structural, optical and magnetic properties of Cu_2O films deposited using a SILAR technique through Fe-doping

S. Satheeskumar[1] · S. Vadivel[2] · K. Dhanabalan[3] · A. Vasuhi[4] · A. T. Ravichandran[5] · K. Ravichandran[6]

Received: 9 November 2017 / Accepted: 20 March 2018

Abstract

Undoped and Ferrous (Fe)-doped Cu_2O thin films were deposited onto glass substrates using successive ionic layer adsorption and reaction method. The variation in the concentration of Fe has significant impact on the final film properties. Fe doping with 5 wt% exhibited major property improvements compared with undoped and Fe doped films. The structural, optical, morphological, magnetic properties and atomic force microscope of the films were systematically investigated. The X-ray diffraction analysis showed that all the films had good crystalline quality and the preferential orientation along (111) plane. Optical studies show that the transmittance and optical band-gap values are maximum (2.5 eV) for the Fe doping level of 5 wt%. The relative errors are calculated for crystallite size and optical energy band gap values. The photoluminescence study confirms the presence of various defects in the Cu_2O matrix. The Fourier transform infrared results confirmed the presence of expected compounds in the samples. The field emission-scanning electron microscope images indicate that there is a gradual decrease in the grain-size with increase in the Fe doping level and a flower-like structure is obtained in the maximum doping level of Fe. The high resolution transition electron microscope reveals single-crystal nature. Magnetic measurements showed that undoped Cu_2O films exhibit diamagnetic behavior and at the maximum (5 wt%) Fe doping level, the films behave as anti-ferromagnetic material. The atomic force microscope reveals that the smoothness of the film surface increases at the maximum doping of Fe concentration.

1 Introduction

Metal oxide materials have a modifications in all fields because of their unique physical and chemical properties. Especially nano structured metal oxide materials are versatile in the applications. Cu_2O is one of the p-type semiconducting metal oxide materials with a direct band gap value of approximately 2.17 eV [1] and it is makes at a promising material for photo-catalytic and solar-cell application. Recently, metal oxide oxide materials have been found applicable in all fields, in their pure and doping films. Cu_2O behaves as the parent compound in many p-type transparent conducting oxides (TCOs: $CuAO_2$—Al, Cr, Ga, etc.,) [2]. The magnetic materials doped with Cu_2O (such as Fe, Ni, Co and Mn) increases the magnetic properties of the semiconducting materials [3]. In Fe-doped Cu_2O delafossite thin films iron is used in layer-quantities and serves as the important transition-element. Cu_2O is a suitable candidate for Bose–Einstein condensation because of its higher binding energy. The material can be used in a wide range applications such as gas sensors [4], Solar energy [5, 6], lithium–ion batteries [7], photo catalyst [8], dilute magnetic

✉ K. Dhanabalan
vasuhidhanabalan@gmail.com

1 Department of Physics, K.S.R. Institute for Engineering and Technology, Tiruchengode, Namakkal, Tamil Nadu, India

2 Department of Physics, Paavai Engineering College (Autonomous), Pachal, Namakkal, Tamil Nadu, India

3 Post Graduate and Research Department of Physics, J.J. College of Arts and Science (Autonomous), Pudukkottai, Tamil Nadu, India

4 Department of Physics, H.H. The Rajah's College (Autonomous), Pudukkottai, Tamil Nadu, India

5 Post Graduate and Research Department of Physics, National College (Autonomous), Tiruchirappalli, Tamil Nadu, India

6 Post Graduate and Research Department of Physics, A.V.V.M. Sri Pushpam College (Autonomous), Poondi, Thanjavur, Tamil Nadu 613 503, India

Published online: 04 April 2018