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. P. K. Praseetha, Head, Department of Nanotechnology, Noorul Islam Centre for Higher Education, Kumaracoil, Kanyakumari.

Dr. P. Kavitha
Assistant Professor
PG &Research Department of Zoology
AVVM Sri Pushpam College (Autonomous)
Poondi-613 503, Thanjavur-Dt, Tamil Nadu, India

Dr. P. K. Praseetha
Head
Department of Nanotechnology
Noorul Islam Centre for Higher Education
Kumaracoil – 629180, Kanyakumari Dt.

Date: 13.06.2019

LINKAGE

For the year 2019-2020

Between

1. Dr. P. Kavitha
Assistant Professor
PG & Research Department of Zoology
A.V.V.M Sri Pushpam College
(Autonomous), Poondi – 613 503.

&

2. Dr. P. K. Praseetha
Head
Department of Nanotechnology
Noorul Islam Centre for Higher Education
Kumaracoil – 629 180, Kanyakumari Dt.

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 INSCST.

P. Kavitha 13/6/19

Dr. P. Kavitha

13/6/19

Dr. P. K. Praseetha

Dr. P. KAVITHA, Ph.D.
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Applied Physics A (2020)126:750
https://doi.org/10.1007/s00339-020-03938-z

Applied Physics A
Materials Science & Processing

Simultaneous doping of higher ionic state metal and surface plasmon resonance-inducing element with ZnO: an effective approach to improve photocatalytic dye degradation

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Received: 4 April 2020 / Accepted: 21 August 2020

Abstract
This study aims to improve the photocatalytic activity of zinc oxide thin films by simultaneously doping with a higher oxidation state transition element and another element with localized plasmon resonance. To achieve this hypothesis, tungsten (W) and copper (Cu) were added to ZnO and the effects of W + Cu co-doping on the photocatalytic activity have been investigated. In addition, the influence of W + Cu co-doping on the structural, optical and surface morphological properties of ZnO has been studied and the obtained results have been correlated with the enhancement in the photocatalytic activity. The concentration of W was kept as 3 wt% and that of Cu was varied as 1, 3 and 5 wt%. The films were deposited on stainless steel mesh substrates. Antibacterial activity test was carried out for all the prepared film samples. The co-doped film with W + Cu doping concentrations 3 + 3 wt% exhibits superior photocatalytic and antibacterial activities when compared with other samples. The reasons and the mechanism behind this enhancement in the photocatalytic and antibacterial activities have been addressed in this paper.

Keywords Higher ionic state metal doping · Surface plasmon resonance · Simultaneous doping · Excess free electron · Photocatalytic and antibacterial activity · W + Cu doping

1 Introduction

Increase in population growth and global industrialization causes a serious threat to the world by polluting the environment [1]. Water pollution caused by textile industries emerges as one of the major concerns when the dyes and chemical compounds used in the textile industries are discharged to the surrounding without proper treatment [2]. It is estimated that nearly 20% of the dye stuffs are gotten rid of during the operational process of textile industries which highly affects the health of human beings and aquatic organisms [3, 4]. Therefore, there is a need for cost-effective methods to purify the wastewater discharged from textile industries. Several water treatment techniques such as membrane filtration, coagulation, adsorption, flocculation, ion exchange and biological purifications are used to remove the organic dyes prevalent in the wastewater. However, it is difficult to meet out the required standards through these methods [5–7].

In the present decades, photocatalytic process has emerged as a powerful and promising method for the removal of organic pollutants prevalent in the wastewater as this process results in harmless end products, viz. H_2O and CO_2. In the recent past, a heterogeneous semiconductor photocatalysis has been shown as a potential method for effective waste water treatment [8, 9]. Among the photocatalysts (such as TiO_2, ZnO, SnO_2, WO_3, Fe_2O_3, $MoSo_4$ and V_2O_5), ZnO is one of the widely used photocatalyst materials as it offer several advantages: non-toxic, low-cost,

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Published online: 30 August 2020

Inorganic Chemistry Communications 118 (2020) 107986

Contents lists available at ScienceDirect

Inorganic Chemistry Communications

journal homepage: www.elsevier.com/locate/inoche

Short communication

Excess free-electrons activated photocatalytic ability of ZnO films through co-doping of higher oxidation state transition metals Ta and Mo

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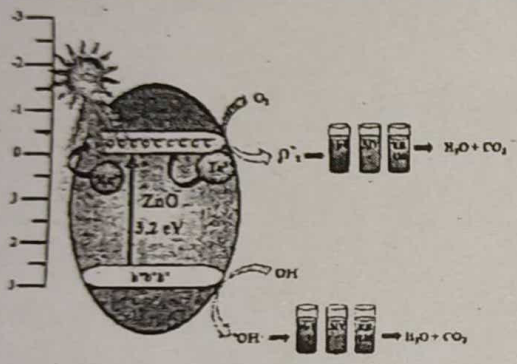
GRAPHICAL ABSTRACT



ARTICLE INFO

Keywords:
Ta and Mo doping
ZnO thin film
Stainless steel mesh substrate
Scavenger test
Photocatalytic dye degradation
Reusability test
Chemical oxygen demand

ABSTRACT

The focus of this article is on the enhancement of free electrons in a ZnO based system to improve its photocatalytic efficiency by adding two higher ionic state elements simultaneously as co-dopants. To realize this idea, tantalum and molybdenum were used as co-dopants to deposit tantalum + molybdenum doped ZnO thin films on stainless steel meshes using a simple spray technique. The photocatalytic activity of this doubly doped film is compared with those of singly doped films i.e. tantalum doped and molybdenum doped films and also with that of the undoped ZnO film. The results reveal that this doubly doped film exhibits superior photocatalytic activity compared with other tested films. The reasons for this enhancement is addressed in detail with the support of trapping/scavenger test. The XPS, photoluminescence and diffuse reflection spectroscopy studies confirm the expected substitutional incorporation of Ta^{5+} and Mo^{6+} ions in the ZnO lattice and the consequent formation of intermediate energy levels in the ZnO based semiconductor system.

1. Introduction

Textile industries have currently been dealing a big problem to remove toxic dyes prevalent in wastewater discharged from dye house. Wastewater from textile industries causes a major ecological problem as it contains toxic dye molecules. Even though several techniques have

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https://doi.org/10.1016/j.inoche.2020.107986
Received 31 March 2020; Received in revised form 2 May 2020; Accepted 23 May 2020
Available online 26 May 2020
1387-7003/