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Accredited B++ Grade by NAAC

Ref.

Year 2017

Date 20

Name of the teacher: Dr. Saurav Dutta

Title of paper: Shallow acceptor state in ZnO realized by ion irradiation and annealing route.

Journal of Alloys and Compounds 703 (2017) 26–31

Contents lists available at ScienceDirect

Journal of Alloys and Compounds

journal homepage: <http://www.elsevier.com/locate/jalcom>

Shallow acceptor state in ZnO realized by ion irradiation and annealing route

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ARTICLE INFO

Article history:
Received 9 December 2016
Received in revised form 25 January 2017
Accepted 29 January 2017
Available online 31 January 2017

Keywords:
Zinc oxide
Ion irradiation
Shallow acceptor
Photoluminescence
Raman spectroscopy

ABSTRACT

Activation of shallow acceptor state has been observed in ion irradiated and subsequently air annealed polycrystalline ZnO material. Low temperature photoluminescence (PL) spectrum of the sample exhibits clear signature of acceptor bound exciton (ABX) emission at 3.360 eV. The other two samples, pristine and ion irradiated (without annealing), however, do not show acceptor related PL emission in the nearby energy region. Electron transition from shallow donor (most probable site is interstitial zinc for undoped ZnO) to such newly formed shallow acceptor state creates new donor-acceptor pair (DAP) luminescence peak – 3.229 eV. ABX and DAP peak energy positions confirm that the acceptor is N related. The acceptor exciton binding energy has been estimated to be 180 ± 15 meV which is in conformity with earlier reports. The activation of shallow acceptors without any source of atomic nitrogen can only be possible through diffusion of molecular nitrogen inside the sample during annealing. The N₂ molecules get trapped at bulk defect sites incorporated by ion irradiation and subsequent annealing. X-ray diffraction (XRD) and Raman spectroscopic (RS) investigation have been employed to probe the changing defective nature of the ZnO samples. Irradiation induced increased disorder has been detected (both by XRD and RS) which is partially removed/modified by annealing at 300 °C. Simultaneous activation of molecular nitrogen acceptor in purposefully defective ZnO is the key finding of this work. Results presented here provide a simple but controlled way of producing shallow acceptor state in ZnO. If optimized through suitable choice of ion, its energy and fluence as well as the annealing temperature, this methodology can trigger further scope to fabricate devices using ZnO epitaxial thin films or nanowires.

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1. Introduction

Nitrogen being the prime suspect of inducing p-type conductivity in traditionally n-type ZnO, large effort has been put forward to dope ZnO by N using various techniques [1–15]. Obviously, N doping replacing an O atom is easier as the ionic radius of N atom is closest to that of O atoms compared to other group V elements. Back in 1988, Gutowski et al. experimentally [16] pointed out the presence of shallow acceptor complexes in ZnO. Further, fabrication of p-type ZnO has been reported by Lok et al. [2], Zeimer et al. [3] and Tsukazaki et al. [4]. A brief summary of other studies can be found in ref. 1. However, optimization of defects, chemical nature of the incorporated N atoms and reproducibility of such results have remained as major source of concern till date [17]. Theoretical calculation [9] followed by its experimental [10] confirmation have revealed that N in an O vacancy site (N_O) is indeed an acceptor but its energy level (~1.3 eV above the valence band maximum (VBM)) does not allow sufficient number of holes to be activated at room temperature (corresponding thermal energy ~ 25 meV). So the shallow N related acceptor as reported by several research groups are most probably not N_O. It has also been pointed out that in ZnO, Zn rich configuration cannot be made p type by N doping only [5,9]. On the other hand, it is natural that abundant Zn vacancies (V_{Zn}) are not helpful to achieve the hole induced conductivity as V_{Zn} being a deep acceptor in ZnO [18]. So the focus has been shifted towards the generation of defect complexes involving N and V_{Zn} with energy

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<http://dx.doi.org/10.1016/j.jalcom.2017.01.137>
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Ref.

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Date 20

Name of the teacher: Gobinda Bhakta

Title of paper: Tear off the mask from the faces- the politics of society in Mahesh Dattani's play, Tara

www.thecreativelauncher.com Vol. II & Issue V (December- 2017) ISSN-2455-6580

The Creative Launcher
An International, Open Access, Peer Reviewed, Refereed, E- Journal in English
UGC Approved

DOI: <https://doi.org/10.53032/tel.2017.2.5.43>

Tear off the Mask from the Faces: The Politics of Society in Mahesh Dattani's Tara

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Abstract
The word politics is related to power. The power is applied to the benefit of society. But now the black hand of politics is used for only the benefit of the particular class of society depriving the other class. This paper deals with the unveiling of the mask of suppression of woman under the male society. Women in society are treated as backward class as they have no right to get equal right justice from the head of society. Society creates a barrier to woman to remain within four walls of ignorance deprive of the light of education. Such kind of women oppression and deprivation are made vivid by Mahesh Dattani's play *Tara* where Tara, a girl is deprived of her right through surgical intervention because of the politics of male dominating society. This political intervention raised the development of a complex series of events and vivified the black hole in the constitution of male dominating society. My purpose in this paper is to highlight the politics of male preference over female child and to unveil black cover of biased and corrupt society through the play. In the present paper I focus my macroscopic point of light on the character Tara, a representative of deprived female society, to point out the macroscopic problem prevalent in our society.

Keywords- *Suppression, Oppression, Deprivation, Corruption, Blind Politics*

Mahesh Dattani, a revolutionary playwright always protests for the aggrieved, marginalised and unprivileged sections of society like eunuchs and physically challenged. His pen always fights for the deprived and socially and economically suppressed and backward class. Basically, his play is heavily charged with socio-political, emotional, physiological and psychological issues. He has skilfully focussed his powerful lens camera on the theme of gender discrimination and maltreatment of female by male and degraded conventional custom of society in his play, *Tara*. He points out the black hole found in the system of society and it lays hidden deep in the blood of its people. *Tara* is a poignant play of two acts

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Year 2017

Date 20

Name of the teacher: Gobinda Bhakta

Title of paper: Illumination of Mind in the light of Sri aurobinmdo's Sonnet

Erothanatos, Vol. 1, Issue 2, 2017:
Editor: Subrata Biswas
URL: www.erathanatos.com

Illumination of Mind in the Light of Sri Aurobindo's Sonnets

GOBINDA BHAKTA

The aim of true poetry is to interpret the hidden meaning that are concealed from the common sight. When the poet approaches in the right direction to bring about the truth of vision, the revelation takes place. The intensity of the inner sight is evidently much stronger in the poet as he is able to awaken the readers to the inner sight as well. Sri Aurobindo points out that "powerful interpretative and intuitive vision of nature and life and man whose poetry has arisen out of that in a supreme revelatory utterance of it" (CWSA 26:30).

Sri Aurobindo speaks of mind and its division into different parts – Higher Mind, Illumined mind, Intuitive mind and Over mind. By Higher Mind, he means it is a mind of larger clarity of spirit, luminous thought – Mind, a mind of spiritual conceptual knowledge. It is the self-revelation of eternal knowledge. It can freely express itself in single ideas but its most characteristic movement is a mass idealisations, a system of totality of truth-seeing at single view. It purifies, delivers and creates through knowledge. Illumined mind is that which lies behind the surface mind (ordinary mind) and can only be directly experienced by sadhana, by breaking down the habit of being on the surface and by going deeper within. It infuses the senses into a direct and total spiritual sensation so that our vital and physical being can contact the divine in all things. It throws a transforming light on the physical mind, which breaks its limitations, inertia, narrow thought power and doubts. Both higher and intuitive mind depend for their authority on a yet higher power, the Intuitive Mind. It transforms not only mind but also heart, life, senses and even body. It changes the whole consciousness into stuff of intuition, for it brings its own greater radiant movement into will, feelings and emotions. Beyond intuitive mind is Over Mind, which is Super mind's delegate to the ignorance. Overmind is the cosmic consciousness. It is the place of God. Overmental plane is the highest consciousness one can achieve without transcending the mental system. Sri Aurobindo speaks of another mind that is Super Mind. Beyond Overmind are the planes of Supermind or unity of consciousness. Supermind is the infinite unitary consciousness or the truth-idea beyond the three lower planes of matter, life and mind. Supermind is the dynamic form of Sachchidananda and the necessary mediator or link between the transcendent Sachchidananda and creation. Sri Aurobindo says,

At the outset man lives in his physical mind which perceives the actual, the physical, the objective and accepts it as fact and this fact is as self-evident truth beyond question: whatever is not actual, not physical, not objective it regards as unreal or unrealised, only to be accepted as entirely real when it has succeed in becoming actual, becoming a physical fact, becoming objective. (The Life Divine 429)

Man is engrossed in worldly dreams and takes material things as real. As he sates in *The Divine Comedy* "... a dream is real to the dreamer so long as he sleeps but waking shows it to be unreal ,so our experience of word seems to us positive and real but when we stand back from illusion, we shall find that it had no reality. ..." (*The Life Divine* 436).

Sri Aurobindo retired completely from the physical atmosphere in order to bring about the descent of what he called the supermind. "By the supermind is meant the full Truth-Consciousness of the Divine Nature in which there can be no place for the principle of division

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