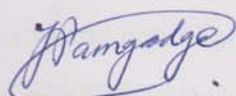


Summary of work done under MRP entitled
“Studies of Non Linear Optical Properties of Some Metal and Metal Oxide
Nanoparticles and Composites”

UGC Reference No. F. 47-411/12 (WRO) dated 16.03.2013

We have investigated the effect of strontium doping on the linear and third order nonlinear optical properties of ZnO-polyvinyl alcohol (PVA) nano-composite thin films. Strontium doped ZnO nanoparticles capped with L-arginine were synthesized by low cost soft chemical route. These nanoparticles were characterized by x-ray powder diffraction, scanning electron microscopy and energy dispersive x-ray spectroscopy for its crystal structure and surface morphology studies. Linear optical responses of these samples were studied by using ultraviolet-visible (UV-vis) spectroscopy and Fourier transform infrared (FT-IR) spectroscopy. Presence of excitonic peaks for doped and undoped ZnO was revealed by UV-vis data and shift of excitonic peaks towards lower energy with increase in dopant concentration was observed. Rotational and vibrational signatures of capping agent and ZnO were confirmed by FT-IR spectroscopy. Third order nonlinearity (nonlinear refraction and absorption) of $Zn_{(1-x)}Sr_xO$ -PVA thin films, deposited on the good optical quality glass substrate, were studied by z-scan technique using He-Ne laser (wavelength 632.8 nm) in continuous wavelength regime which shows negative nonlinearity with self-defocusing effect. The large value of n_2 ($10^{-4} \text{ cm}^2/\text{W}$) is obtained for 5 wt% strontium doped ZnO-PVA thin film and is attributed to the thermal effect. Enhanced nonlinear absorption due to reverse saturable absorption and weak free carrier absorption is observed for all undoped and doped ZnO-PVA thin films and is prominent for 5 wt% doping of strontium. Third order nonlinear susceptibility ($\chi_{eff}^{(3)}$) is calculated for all samples. We have investigated thermally stimulated third order NLO properties of Cu-PVP nanocomposite thin films. Cu nanoparticles have been synthesized using chemical reduction method and thin films in PVP matrix have been obtained using spin coating technique. Thin films have been characterized by XRD, FESEM, UV-vis, FT-IR, etc. for structural and linear optical studies. Cu-PVP nanocomposites are found to exhibit strong nonlinear refractive index stimulated by thermal lensing effect.



[Mr. Y. S. Tamgadge]
Principal Investigator



[Dr. S. G. Bhadange]

Principal

PRINCIPAL
 Shri Shivaji College of Arts,
 Shri Shivaji College, Kolala
 A Grade C.GPA. 3.11, by NAAC

**University Grants Commission
Western Regional Office
Ganeshkind, Pune - 4411007**

**PROFORMA FOR SUBMISSION OF INFORMATION AT THE TIME OF SENDING THE
FINAL REPORT OF THE WORK DONE ON THE PROJECT**

1. Title of the Project: **“Studies of Non Linear Optical Properties of Some Metal and Metal Oxide Nanoparticles and Composites”**
2. NAME AND ADDRESS OF THE PRINCIPAL INVESTIGATOR: YUORAJ S. TAMGADGE
ASSISTANT PROFESSOR
DEPARTMENT OF PHYSICS
SHRI SHIVAJI COLLEGE, AKOLA
SHRI SHIVAJI COLLEGE, AKOLA
3. NAME AND ADDRESS OF THE INSTITUTION: SHRI SHIVAJI COLLEGE, AKOLA
4. UGC APPROVAL LETTER NO. AND DATE: 47-411/12 (WRO) dated 16.03.2013
5. DATE OF IMPLEMENTATION: 16TH MARCH 2013
6. TENURE OF THE PROJECT: 2 YEARS
7. TOTAL GRANT ALLOCATED: RS. 1,40,000/-
8. TOTAL GRANT RECEIVED: RS. 1,05,000/-
9. FINAL EXPENDITURE: RS. 1,41,787/-
10. TITLE OF THE PROJECT: **“Studies of Non Linear Optical Properties of Some Metal and Metal Oxide Nanoparticles and Composites”**
11. OBJECTIVES OF THE PROJECT: To Synthesize Cu NPs, ZnO NPs and their composites in PVA matrix and to study their third order NLO properties using Z-Scan
12. WHETHER OBJECTIVES WERE ACHIEVED (GIVE DETAILS): YES
 - Undoped and doped ZnO-PVA and Cu-PVA nanocomposite thin films were prepared.
 - Thin films and nanopowders have been characterized by various techniques for structural and optical studies.
 - Third order nonlinear optical properties have been studied using Z-scan technique under low power He-Ne CW laser at 632.8 nm.
 - Necessary facilities to synthesize and characterize nanoparticles have been established in the institution.
13. ACHIEVEMENTS FROM THE PROJECT:
 - Necessary facilities to synthesize and characterize nanoparticles have been established in the institution.
 - Results have been reported and published in peer reviewed International Journals.
 - Results have also been communicated to various conferences and Seminars.
 - Project has helped in the completion of PhD work.
- (xv) 14. SUMMARY OF THE FINDINGS (IN 500 WORDS): **Please see Appendix C for the Summary and Appendix D for the Final Report of the Project.**

15. CONTRIBUTION TO THE SOCIETY (GIVE DETAILS):

Results obtained from the project may be very useful for the nonlinear applications of nanoparticles and nanocomposites. The nanostructured materials obtained may find applications in nonlinear optical devices e.g. optical limiting.

16. WHETHER ANY PH.D. ENROLLED/PRODUCED OUT OF THE PROJECT:

Yes

Principal Investigator had already been registered for PhD degree on the topic "DESIGN AND DEVELOPMENT OF NANO-COMPOSITES FOR NONLINEAR OPTICAL APPLICATIONS" at Sant Gadge Baba Amravati University, Amravati in January 2012.

Name of Guide: Dr. G. G. Muley, Department of Physics, SGB Amravati University, Amravati.

17. NO. OF PUBLICATIONS OUT OF THE PROJECT (PLEASE ATTACH):

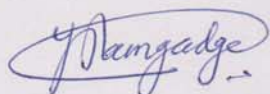
Research Papers Published in International Journals:

Sr. No.	Title of the Paper and Authors	Journal Name, Vol., Year, Page no., (Publisher)	Impact factor and Citations
1.	Thermally stimulated third order optical nonlinearity in Cd doped CuO-PVA thin films under cw laser illumination Y. S. Tamgadge, V.G. Paturkar, S. S. Talwatkar A. L. Sunatkari, G. G. Muley	Appl. Phys. B (2015) (Springer) Status: Revision under Review	Impact factor: Citations: Nil
2.	Linear and nonlinear optical properties of nanostructured Zn _(1-x) Sr _x O-PVA composite thin films Y.S. Tamgadge, A.L. Sunatkari, S.S. Talwatkar, V.G. Paturkar, G.G. Muley	Opt. Mater. 37 (2014) 42-50 (Elsevier)	Impact factor: 2.044 Citations: 2
3.	Thermo-Optical Properties of Amino Acid Modified ZnO-PVA Colloidal Suspension under CW Laser Illumination Y.S. Tamgadge, V.G. Paturkar, A.L. Sunatkari, S.S. Talwatkar, G.G. Muley	Macromolecular Symposia (2015) (Wiley VCH) Accepted	Impact factor: 0.913 Citations: Nil
4.	Nonlinear absorption of L-arginine capped ZnO nano-suspension Y. S. Tamgadge, R. V. Salodkar, S. B. Sawarkar, A. L. Sunatkari, G. G. Muley	International Journal of Basic and Applied Research Special Vol. no. 4 (2014) 49-52.	Impact factor: 1.200 Citations: Nil
5.	Developments in Nonlinear Optics-A Review Y. S. Tamgadge, G.G. Muley	Bionano Frontier Special Issue (2011), 145-147	Impact factor: 0.23 Citations: Nil

Research Papers Presented in Conference/Seminars:

Sr. No.	Title of the Paper and Authors	Name of the Conference/Seminar and Year	Place
1.	Linear and Nonlinear Optical properties of L-arginine encapsulated ZnO nano-suspension Y. S. Tamgadge, A. L. Sunatkari, S. A. Sunatkari, V.	International conference on Nanotechnology 25-26 Oct, 2013.	Haldia Institute of technology, Haldia (WB)

	G. Paurkar, G. G. Muley		
2.	Effect of Capping Agents on the Particle Size of ZnO Quantum Dots Y. S. Tamgadge, A. L. Sunatkari, S. S. Talwatkar, S. B. Sawarkar, R. V. Salodkar, V. G. Paurkar, G. G. Muley	National Conference on Upcoming Trends in Chemical Science 27-28 Sept, 2013	Anand college, Pathardi, dist Ammednagar (MS)
3.	Optical and Structural Properties of L-Alanine Capped ZnO Quantum Dots Y. S. Tamgadge, A. L. Sunatkari, S. S. Talwatkar, S. M. Palhade, S B Sawarkar, M R Belkhedkar, G. G. Muley	National Conference on Upcoming Trends in Chemical Science 27-28 Sept, 2013	Anand college, Pathardi, Dist. Ammednagar (MS)
4.	Effect of PVP as capping agent on the optical properties of ZnO nanoparticles Y. S. Tamgadge, R. V. Sangludkar, R. V. Salodkar, S. B. Sawarkar, G. G. Muley	National conference on "Recent Trends in Mathematics, Physics and their Applications", 19 March, 2014	Shri Khandelwal College, Akola (MS)
5.	Effect of L-arginine as capping agent on the optical properties of ZnO nanoparticles V. A. Kamble, Y. S. Tamgadge, M. R. Belkhedkar, N.B. Thakare, P. P. Gedam, G. G. Muley	National conference on "Recent Trends in Mathematics, Physics and their Applications", 19 March, 2014	Shri Khandelwal College, Akola (MS)
6.	Effect of dopant on the nonlinear optical absorption properties of ZnO-PVA nanocomposite thin films Y. S. Tamgadge, G. G. Muley, A. A. Pakhale, G. B. Harde, V. G. Paurkar	National Conference On Recent Development in Material Science And Technology 11 October 2014	Arts, Commerce & Science College, Koradi Dist. Nagpur (MS)



SIGNATURE OF THE
PRINCIPAL INVESTIGATOR
[Mr. Y S Tamgadge]



PRINCIPAL

[Dr. S. G. Bhadange]

Shri Shivaji College, Akola.

**Shri Shivaji College of Arts,
Commerce & Science, AKOLA**
A Grade C.GPA. 3.11, by NAAC

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File No: 47-411/12(WRO)

The Accounts Officer
University Grants Commission
Ganeshkhind, Pune-411007.

16 MAR 2013

**Subject: Financial assistance to college teachers for undertaking Minor Research Projects -
Release of first installment during XIIth Plan.**

Sir/Madam,

The UGC on the recommendations of the Expert Committee has approved the Minor Research Project in the subject of Physics entitled "Studies of Non Linear Optical Properties of some Metal and metal Oxide Nanoparticles and Composites" to be undertaken by Mr. Tamgadge Y. S., of SHRI. SHIVAJI ARTS COMM AND SCIENCE COLLEGE, NEAR SHIVAJI PARK, AKOLA, AKOLA-444 003. The financial assistance of the UGC would be limited to Rs. 140000/- (Rupees Only) for a period of two years. An amount of Rs. 105000/- (Rupees Only) is presently being sanctioned as the first installment.

Non-Recurring Grant for Two years	Amount (Rs)	Recurring grant	1 st Year Amount	2 nd Year Amount	Head of a/c
Books & Journals	10000	Contingency	15000	15000	4(iv)b (For General)
Equipment	60000	Special Need	0	0	
		Travel/Field work	5000	5000	1.B(i)h(i)b (For SC)
		Chemicals & Glassware	15000	15000	1.B(i)h(i)b (For ST)
		Others	0	0	
Total (Rs.)	70000		35000	35000	

Total amount for the project: Rs. 140000/-

The grant is subject to the terms and conditions as mentioned below.

1. A Certificate of Acceptance of the conditions governing the research project should be sent immediately to this office.
2. The amount of the grant shall be drawn by the Accounts Officer (D.D.O), University Grants Commission on the grant-in-aid bill and shall be disbursed to and credited to the above-mentioned institute through D.D./ RTGS Confirmation No/ NEFT/ Transfer No.
3. The sanctioned amount is debatable to the Major Head 4(iv)b(For General), 1.B(i)h(i)b (For SC), 1.B(i)h(i)b (For ST) and is valid for payment during the financial year 2012 -2013 only.
4. The grant is subject to adjustment on the basis of Utilization Certificate in prescribed proforma submitted by University/College/Institute.

NOTE:

1. The grant shall not be used self-financial/ non-grant/unaided courses & teachers.
2. Date of implementation will be the date of sanction of first installment.
3. The researcher is required to submit an Acceptance Certificate of the project in the enclosed format to the affiliating university, which would then be sent to UGC (WRO) in a bunch by the University.