Criterion-1: Curricular Aspects

Key Indicator – 1.3: Curriculum Enrichment

Metric: 1.3.3

Programme: M.Sc. Physics

Syllabus	https://www.du.ac.in/uploads/RevisedSyllabi1/Annexure-18.%20Revised_MSc_Physics_course_version-R1.pdf
List of Students	Annexure-I
Sample Project Reports	Annexure-II

Annexure-I

List of Students

DEPARTMENT OF PHYSICS AND ASTROPHYSICS

Dissertation Allotment List

M.Sc. Final Year (2022-2023 Batch)

S.No.	Name	Roll No.	Supervisor	Semester (s)
1	Deeksha Singh	21025762016	Prof. Mohd. Naimuddin	IV
2	Diksha Sharma	21025762018	Prof. S. Annapoorni	IV
3	Latika	21025762031	Prof. Patrick Das Gupta	IV
4	Pankaj Pawar	21025762039	Prof. Patrick Das Gupta	IV
5	Saurabh Singh	21025762055	Prof. S.A. Hashmi	III + IV
6	Shubham Kumar Tiwari	21025762058	Prof. Debajyoti Choudhaury	III + IV
7	Sudipta Mondal	21025762060	Prof. Debajyoti Choudhaury	III + IV
8	Aarushi Rawat	21026762001	Prof. T.R. Seshadri	III + IV
9	Ananthakrishnan R	21026762007	Prof. Kirti Ranjan	III + IV
10	Himanshu	21026762019	Prof. Nivedita Deo	III + IV
11	Sunidhi Rajpal	21026762055	Prof. S.K. Mandal	III + IV
12	Supriya Garg	21026762056	Prof. Nivedita Deo	III + IV
13	Yash Yadav	21026762067	Dr. P. Senthil Kumar	III + IV
14	Yogita Kumari	21026762068	Prof. Patrick Das Gupta	IV
15	Aakash Malik	21026762069	Prof. Patrick Das Gupta	III + IV
16	Kaushkee Vats	21036762020	Dr. Jyoti Rajput	III + IV
17	Nishtha Lakhanpal	21036762036	Prof. Mohd. Naimuddin	III + IV
18	Sachin	21036762045	Dr. Suresh Kumar	III + IV
19	Shakuntala Kumari	21036762050	Dr. Debabrat Mishra	III + IV
20	Shiv Prakash Mishra	21036762052	Dr. Abhass Kumar	IV
21	Shivam Bhati	21036762053	Prof. S.K. Chamoli	III + IV
22	Shivam Kumar	21036762054	Prof. Poonam Silotia	III + IV
23	Tushar Bhalla	21036762065	Prof. S. Somorendro Singh	III + IV
24	Mansi Dagar	21047762012	Prof. S. Annapoorni	IV
25	Medha Bhindwar	21047762014	Prof. Awadhesh Prasad	IV
26	Runjhun Mittal	21047762027	Dr. Sumalay Roy	III + IV
27	Seema Sahu	21047762028	Prof. Amarjeet Kaur	III + IV
28	Tanya Wadhwa	21047762033	Prof. Anjan Dutta	III + IV
29	Jasbir Singh	21056762033	Prof. Sanjay Jain	III + IV
30	Dhruv Jain	21068762001	Prof. Awadhesh Prasad	III + IV
31	Shreyashi Tiwari	21068762005	Prof. Amita Chandra	IV
32	Mallicka Kundu	21079762011	Dr. Suresh Kumar	IV
33	Manurena Gupta	21079762012	Prof. Mohd. Naimuddin	IV
34	Pushpendra Kapri	21080762004	Dr. S.K. Verma	III + IV

Brajesh
09.09.2022

प्रो. ब्रजेश चन्द्र चौधरी/Prof. B. C. Choudhary
विभागाध्यक्ष / Head
भौतिकी एवं खगोल भौतिकी विभाग
Department of Physics & Astrophysics
दिल्ली विश्वविद्यालय/University of Delhi
दिल्ली–110007/Delhi-110007

Annexure-II

Sample Project Reports

Certificate of Declaration

This is to certify that the M.Sc. Dissertation entitled **"Thermal Plasma Deposition of Aluminium on Glass Substrate"** submitted to the University of Delhi by **RISHABH PRAJAPATI**, in partial fulfilment of the requirements for the award of the degree of M.Sc. in Physics, is a record of her own research work. He has carried out research since **15 Sept., 2020** at the Department of Physics and Astrophysics, University of Delhi, Delhi, India. To the best of our knowledge, no part of the dissertation has been submitted for the award of any other degree by anybody in any other university.

Date: 01 January 2021

DN Gupta

Dr. Devki Nandan Gupta
Assistant Professor
Department of Physics & Astrophysics
University of Delhi,
Delhi-110007

Dr. Devki Nandan Gupta
(Supervisor)
Department of Physics & Astrophysics
University of Delhi

Four-form Gravity and Torsion

April 25, 2019

Dissertation submitted to Department of Physics and Astrophysics, University of Delhi, in partial fulfillment of the requirements, for the degree of M.Sc, in Physics.

Submitted by

Rupak Bag

Under the Supervision of **Prof. Patrick Das Gupta**.

Certificate of Declaration

This is to certify that the M.Sc. Dissertation entitled **"Terahertz radiation generation from laser-plasma interactions**" submitted to the University of Delhi by **NAMRATA SHARMA** (Roll No. 19036762038, M.Sc.-Physics Sem.-IV), in partial fulfilment of the requirements for the award of the degree of M.Sc. in Physics, is a record of her own research work. She has carried out research since **15 Jan., 2021** at the Department of Physics and Astrophysics, University of Delhi, Delhi, India. To the best of our knowledge, no part of the dissertation has been submitted for the award of any other degree by anybody in any other university.

Date: 27 June 2021

DN Gupta

Dr. D. N. Gupta
Associate Professor
Department of Physics & Astrophysics
University of Delhi
Delhi-110007, India

Dr. Devki Nandan Gupta
(Supervisor)
Department of Physics & Astrophysics
University of Delhi

PLASMONIC BASED SENSORS

Dissertation Report submitted to

University of Delhi

by

Tarun Yadav

M.Sc. Physics

(1886955)

Under the supervision of

Prof. S. Annapoorni

Department of Physics and Astrophysics

University of Delhi

New Delhi,110007

DECLARATION

I hereby declare that the report titled, ***'Plasmonic Based Sensors'***, submitted to the University of Delhi for the award of the Degree of M,.Sc. in Physics, is the record of work carried out by me during the period from January 2020 to April 2020, under the guidance of **Prof. S.Annapoorni**, Department of Physics and Astrophysics, University of Delhi, 110007, and that it has not formed the basis for the any Degree,Diploma and Titles in this University or any other University or other similar Institution of Higher Learning.

From wherever I have used the text, data and simulation techniques, I have given the credits by citing them in the text of the report and have given credits in reference.

I have followed the norms and guidelines of the University while carrying out this work.

Date: June 2020

Place: Delhi

Tarun Yadav

M.Sc. Physics

1886955

DEPARTMENT OF PHYSICS AND ASTROPHYSICS

UNIVERSITY OF DELHI

DELHI, 110007

CERTIFICATE

This is to certify that all the content of Dissertation Report entitled "**Plasmonic based sensors**" is a bonafied work carried out by Tarun Yadav (Roll no.1886955) to University of Delhi towards partial fulfilment of requirements for the award of Degree of M.Sc. Physics. This work was carried out by him in his IV semester under my guidance and supervision at Department of Physics and Astrophysics.

Date: June 2020

Place: Delhi

Prof. S. Annapoorni

Department of Physics and Astrophysics

University of Delhi

Abstract

The present work focuses on the surface plasmon resonance based sensors for potential applications as sensors, especially in the area of biosensing. Theoretical simulations based on Mie Theory are performed to optimize the experimental parameters such as refractive index of medium for sensing applications. Finite difference time doman (FDTD) analysis were performed to understand the field enhancement in nanostructures and compare the parameters with Mie simulations.

Surface plasmon resonance (SPR) refers to the collective oscillations of the conduction electrons in metallic nanostructures. Both the intensity and the position of the SPR strongly depend on the size, shape and composition of the nanostructures, as well as the dielectric properties of the surrounding environment.This variety of responsive variables allows for optical sensors to be created using plasmonic metallic nanostructures. Hence plasmon-enhanced optical sensors are finding increasing application in detection of analytes in biomedical diagnosis, homeland security, food safety and environmental monitoring. “Plasmonic sensor” here refers to sensors that directly utilize shifts in the spectral properties of the plasmon to act as the transducer of the sensing signal.

The variation in the resonant wavelength induced by silver nanoparticle size and the dielectric constant of the medium observed experimentally using optical absorption is compared with the existing theories. The experimentally observed plasmonic resonances along with the simulations are very important for developing optical based sensors.

Contents

Microstructural investigation of ZnO nanoparticles using Rietveld Refinement method

(Dissertation)

Advisor

Prof. Shyama Rath

by

Monalisha Patra

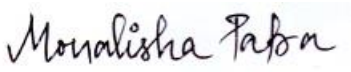
Examination Roll No-20047762017

Department of Physics and Astrophysics

University Of Delhi

Declaration

I, Monalisha Patra, declare that the dissertation titled **"Microstructural investigation of ZnO nanoparticles using Rietveld Refinement method"** and the work presented in it are my own. This work was done wholly during my Masterôs degree work of others and stated the references wherever needed and this is always clearly attributed. I have quoted from the work of others and the source is always given. Except for such quotations, this thesis is entirely my work. I have acknowledged all main sources of help. While carrying out this work, I have followed the norms and guidelines of the University.

Sign: 

Date: 30-04-2022

Place: Delhi

Certificate

This is to certify that the dissertation entitled**, 'Microstructural investigation of ZnO nanoparticles using Rietveld Refinement method'** submitted by Ms. Monalisha Patra to Department of Physics and Astrophysics in partial fulfilment for the awa bonafide work carried out by her under my guidance.

To the best of my knowledge, the work presented here has not been previously submitted to any institution for the award of any degree.

Date: 30th April 2022

Place: Delhi

Prof. Shyama Rath

Department of Physics and Astrophysics

University of Delhi

Acknowledgments

I would like to express my sincere gratitude to my thesis advisor, Prof. Shyama Rath from the Department of Physics and Astrophysics, University of Delhi, for introducing me to this topic and encouraging me to acquire this valuable skill relevant for understanding the properties of materials. I am grateful for her motivation, support, and guidance during my thesis. It would have been tough for me to complete my project without her. A very big thanks to Mr. Gaurav Gupta for his consistent guidance, helpful approach, and support throughout this project. I would also like to thanks my beloved senior Ms. Pragati Sharma for making me learn about the fundamentals and her guidance through the work. They consistently allowed this project to be my work but steered me in the right direction whenever they thought I needed it. I would sincerely want to thank you all once again for giving me this meaningful platform which turned out to be a handful of valuable experience.

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Simulations of the optical properties of metal nanoparticles

Dissertation Report

Under the supervision of

Prof. Shyama Rath

by

Pragati Sharma
M.Sc. Physics
(19068762006)

Department of Physics and Astrophysics
University of Delhi
Delhi-110007

Declaration

I hereby declare that the report titled, **'Simulations of optical properties of metal nanoparticles and determination of size of metal NP's'**, submitted to the University of Delhi for the award of the Degree **M.Sc. in Physics**, is the record of bonafied work carried out by me during the period from **September 2020 to December 2020**, under the guidance of **Prof. Shyama Rath**, Department of Physics and Astrophysics, University of Delhi, Delhi-110007.

The results in the dissertation have not been previously submitted to any institution for the award of any degree or otherwise.

While carrying out this work, I have followed the norms and guidelines of the University.

Date: January 2021
Place: Delhi

Pragati Sharma
M.Sc. Physics
19068762006

DEPARTMENT OF PHYSICS AND ASTROPHYSICS
UNIVERSITY OF DELHI
DELHI, 110007

Certificate

This is to certify that the dissertation entitled**, "Simulations of optical properties and determination of size of metal nanoparticles"**, submitted by **Pragati Sharma**, a final year student of SGTB Khalsa College, pursuing MSc Physics, in partial fulfilment for the award of Master's Degree in Science to Department of Physics and Astrophysics, University of Delhi is a record of bonafide work carried out by her under my supervision and guidance.

The results in the dissertation have not been previously submitted to any institution for the award of any degree or otherwise.

Shyama Rath

Date: 05th January 2021
Place : Delhi

Prof. Shyama Rath
Department of Physics and Astrophysics
University of Delhi

Abstract

Nanoparticles are the particles with the length of <100 nm at least in one direction. Their properties are different from the bulk particles of same element/ compound. Due to the presence of Quantum effects in smaller dimensions, the properties become dependent on size and show variation from bulk materials.

A dispersion of nanoparticles appears macroscopically homogeneous but microscopically inhomogeneous. Nanoparticles act as a bridge between the atomic and macroscopic world.

The main thing, which was focused here, was the dependence of optical properties of Gold (Au) and Silver (Ag) nanoparticles on size and wavelength. The size and wavelength dependence was seen using multiple scattering theory and expected plots were received. Then for determining the size of nanoparticles, we used same theory and got experimental plots. Fitting the experimental and theoretical plots helped us to get to know about the size of nanoparticle.

MATLAB software was used in simulation and determination of size of nanoparticles. The zip file used here to run Mie Theory codes was **SPlaC-v1_01.zip**, which is available online. More than the expected time was spent learning this software and simulating the data. The main focus was to study the optical properties of gold nanoparticles with a flavour of silver nanoparticles included. The use of UV-Visible Spectrometer was not done here in person as due to lockdown there was constraint on working in the department. However, through online mode of experimental solid-state lab module, a brief idea of how it gives experimental data was provided by the Supervisor.

Contents

Microstructural Investigations of Metal-Oxide Nanoparticles

DISSERTATION REPORT

under the supervision of

Prof. Shyama Rath

Submitted by:

ONIMA BISHT

M.Sc. Physics
(19025762029)

DEPARTMENT OF PHYSICS AND ASTROPHYSICS,

UNIVERSITY OF DELHI

DELHI-110007

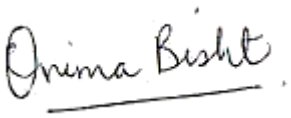
June 30, 2021

Declaration

I hereby declare that the report titled "**Microstructural investigations of metal-oxide nanoparticle**s", submitted to University of Delhi for the award of the Degree **M. Sc in Physics** is the record of bonafide work carried out by me during the period from **January 2021 to May 2021**, under the guidance of **Prof. Shyama Rath**, Department of Physics and Astrophysics, University of Delhi, Delhi – 110007.

The results in the dissertation have not been submitted previously to any institution for the award of any degree or otherwise.

While carrying out this work, I have followed the norms and guidelines of the University.



Date: 27th June, 2021
Place: Delhi

Onima Bisht
M.Sc. Physics
(19025762029)

Certificate

This is to certify that the dissertation titled "**Microstructural and optical investigations of metal-oxide-semiconductor nanoparticles**" submitted to the Department of Physics and Astrophysics, University of Delhi by **Onima Bisht** for the partial fulfilment of the requirements for the degree of **Master of Science in Physics**, 2019-21 is a record of bonafide work carried out by her under my supervision and guidance.

The results in the dissertation have not been previously submitted to any institution for the award of any degree or otherwise.

Shyama Rath
29/06/2021

Date: 29 June, 2021

Place: Delhi

Supervisor:

Prof. Shyama Rath

Department of Physics and Astrophysics,

University of Delhi, New Delhi, 110007.

Abstract

The accurate measurement of particle sizes has been of fundamental and primary importance in nanoscience. In the following project, nickel oxide nanoparticles are synthesized via the sol-gel route using nickel acetate tetrahydrate and methanol as precursors. The characterization techniques used in the present study are **X-ray diffraction, Transmission Electron Microscopy (TEM) and Vibrating Sample Magnetometer (VSM)**. The structural properties of samples annealed at 400ºC, 600ºC, and 800ºC were studied and analysed using the x-ray diffraction technique. The highest peak intensity was displayed by nanoparticles annealed at 800^0C. The crystallite size of the nanoparticles increased from 12 – 27 nm with the increase in annealing temperature. The XRD patterns were plotted in the **Origin software** where the average crystallite size and stress of nanoparticles at the three annealed temperatures were calculated using the Scherrer's Equation and Williamson Hall analysis. TEM Data for nickel oxide nanoparticles prepared at 600^0C was provided to study their morphology. **ImageJ software** was used to calculate the average grain sizes of the particles. A comparative study of XRD and TEM data annealed at 600^0C was done and the reasons for different results were concluded. Further, **Rietveld refinement analysis, using FullProf software**, was performed on the model structure to get more refined and detailed parameters of the nanoparticles. The refinement was also tried on three models of non-stoichiometric Nickel Oxide (NiO_x, Ni_xO, $Ni_{1-x}O_x$), but the results were not satisfactory. The magnetic properties of NiO nanoparticles were also characterized using Vibrating Sample Magnetometer (VSM). The hysteresis curves for the three samples were compared and plotted using the Origin software.

Table of Contents

SEMICONDUCTOR RADIATION DETECTORS: ELECROSTATICS AND FABRICATION PROCESS

Dissertation

by

Niladri Mohan Das

Under the supervision of

Prof. Shyama Rath

Department of Physics and Astrophysics
University of Delhi
Delhi-110007

DECLARATION

I do hereby declare that the dissertation entitled, **"Semiconductor Radiation Detectors: Electrostatics and Fabrication Process",** submitted to the Department of Physics and Astrophysics, University of Delhi, for the award of Master's Degree in Science is a record of bonafide work carried out by me during the academic session 2020-21, from September 2020 to December 2020 under direct supervision and guidance of Prof. Shyama Rath and that it has not formed the basis of any diploma, degree or otherwise in this university or any other equivalent institution of higher education.

From wherever I have used text or data, I have given due credits through citations in the text or in the references.

I have adhered to the norms and guidelines of the University while carrying out this work.

Niladri Mohan Das

Date: 05.01.2021

Place: Balasore

Niladri Mohan Das

MSc Physics

(19068762005)

Department of Physics and Astrophysics
University of Delhi
Delhi-110007

CERTIFICATE

This is to certify that all the contents of the dissertation entitled, **"Semiconductor Radiation Detectors: Electrostatics and Fabrication Process"**, submitted to the University of Delhi, in partial fulfillment of requirements for the award of Master's Degree in Science, is a record of bonafide work carried out by **Niladri Mohan Das** (19068762005) in his IIIrd semester during the academic session 2020-21, from September 2020 to December 2020, under my direct supervision and guidance.

Shyama Rath

Date: 05/01/2021
Place: Delhi

Prof. Shyama Rath
Department of Physics and Astrophysics,
University of Delhi

ABSTRACT

Solid State Detectors, semiconductor ones in particular can detect a wide range of radiation from slow moving protons to electro-magnetic waves, and give a proper energy resolution.

This report consists of the electrostatics of a p-n junction diode (Si) used as a radiation detector. Dependent parameters like width of depletion layer, dopant concentration etc and calculated from the data using MATLAB. The plots related to electrostatics including potential profile are generated by simulating a mathematical model of the diode. Some parameters like surface area of diode are varied in the simulation and their effects on the results are studied. The aim is to enhance the understanding of the mechanisms underlying the degradation of the performances of semiconductor devices induced by ionizing radiation.

The capacitance and voltage data are provided through my supervisor's collaboration with International Atomic Energy Agency (CRP F11016).

The report includes the use of a Schottky diode as a detector, with several advantages over a p-n junction diode, along with its' fabrication.

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