THIN FILM

Thesis submitted in partial fulfillment of the requirements
For the degree of
Master Of Science
(M. Sc)

in PHYSICS

By

PRITIRANEE BEHERA

ROLLNO: -MSc/Phy/22-014

Supervised by

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KENDRAPARA AUTONOMUS COLLEGE KENDRAPARA

THIN FILM

Abstract

Since its discovery in early times, thin films rapidly found industrial applications such as in decorative and optics purposes. With the evolution of thin film technology, supported by the development of vacuum technology and electric power facilities, the range of applications has increased at a level that nowadays almost every industrial sector make use of them to provide specific physical and chemical properties to the surface of bulk materials. The possibility to tailor the film properties through the variation of the microstructure via the deposition parameters adopted in a specific deposition technique has permitted their entrance from the simplest like protective coatings against wear and corrosion to the most technological advanced applications such as microelectronics and biomedicine, recently. In spite of such impressive progress, the connection among all steps of the thin film production, namely deposition parameters-morphology and properties, is not fully accurate. Among other reasons, the lack of characterization techniques suitable for probing films with thickness less than a single atomic layer, along with a lack of understanding of the physics have impeded the elaboration of sophisticated models for a precise prediction of film properties. Furthermore, there remain some difficulties related to the large scale production and a relative high cost for the deposition of advanced structures, i.e. quantum wells and wires. Once these barriers are overcome, thin film technology will become more competitive for advanced technological applications.

Keywords: thin films, deposition techniques, characterization, properties, inorganic and organic, applications, structure and morphology, challenges

Synthesis and Characterization of ZnO-TiO_2 nanocomposite

A thesis submitted for the requirement for the award of degree of

Master of Science

in

Physics

by

BIBHUTI BHUSAN

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Hiranmaya Mishra

ABSTRACT

In this project work, we report the synthesis of ZnO-TiO_2 nanocomposite and it is characterized by different characterization techniques. In this process, ZnO-TiO_2 nanocomposite is synthesized by the wet chemical method. we use different techniques. To identify the crystalline structure, chemical composition, morphology of atoms, UV -visible, and energy band gap of nanoparticles, the XRD shows that the formation of ZnO-TiO_2 in the composite structure, according to the SEM image we can observe the spherical structure of the synthesized nanocomposite And the EDS observation represents the weight% and atomic% of material involved in the synthesized nanocomposite. the amount of ZnO and TiO_2 present in the sample, to determine the band gap energy and the wavelength range we use UV-Visible spectrum and DLS technique is used to calculate the particle of the nanocomposite.

SUBMISSION OF DISSERTATION

DEPARTMENT OF PHYSICS, KENDRAPARA AUTONOMOUS COLLEGE , KENDRAPARA

Raman Spectroscopy of Aqueous Solution

STUDENTS NAME-RAJESH BARIK ,M.Sc-3rd SEMESTER

Roll No – M.Sc/phy-22-015

SUPERVISOR'S NAME-Dr. ANANTARAM PANDA

ASISTANT PROFESSOR, DEPT OF PHYSICS

STUDY OF STRUCTURAL AND OPTICAL PROPERTIES OF HAFNIUM DOPED BARIUM TITANATE

A Dissertation Submitted for the partial fulfillment of the requirement for the

DEGREE OF MASTER SCIENCE

IN PHYSICS

BY

MAMATA DASH

Roll No: MSc/phy/22-001

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KENDRAPARA AUTONOMOUS COLLEGE
ତମସୋ ମା ଜ୍ୟୋତିର୍ଗମୟ
ESTD.1959

DEPARTMENT OF PHYSICS

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KENDRAPARA, 754211

ABSTRACT

Materials that integrate more than one useful property in single and multiphase structures are known as multifunctional materials. Most of them fall in the category of ABO_3 perovskite type and in recent times , these materials have attracted considerable attention from engineers and scientists around the globe for electronic devices for the future. Among the perovskites, barium titanate-based structures have emerged at the top for modern research in advanced materials. In this study, $BaHf_{1-x}Ti_xO_3$, x = 0.00, 0.02, materials were synthesized by solid state reaction method and their optical properties were studied. X-ray diffraction (XRD) confirmed that , with the addition of Hf , the lattice parameter changes causing the shift (through very less) in peaks as compared to undoped BT and the increase in intensity in the doped sample can be due to the substitution of Hf in the Ti lattice sites due to larger atomic radius of Hf. Ultraviolet-visible spectroscopy of $BaHf_{1-x}Ti_xO_3$ showed a slight increase in bandgap energy with the increase of Hf^{4+}. Photoluminescence spectra confirmed the confirmed the three colours (blue , green and red) with the intensity of emission increasing with Hf^{4+} doping.

THE ROLE OF GIANT IMPACT IN PLANET FORMATION

Thesis submitted in partial fulfillment of the requirements
For the Degree of
Master Of Science
(M.Sc)

in PHYSICS

By

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ABSTRACT

Planets are expected to conclude their growth through a series of giant impacts: energetic, global events that significantly alter planetary composition and evolution. Computer models and theory have elucidated the diverse outcomes of giant impacts in detail, improving our ability to interpret collision conditions from observations of their remnants. However, many open questions remain, as even the formation of the Moon—a widely suspected giant-impact product for which we have the most information—is still debated. We review giant-impact theory, the diverse nature of giant-impact outcomes, and the governing physical processes. We discuss the importance of computer simulations, informed by experiments, for accurately modeling the impact process. Finally, we outline how the application of probability theory and computational advancements can assist in inferring collision histories from observations, and we identify promising opportunities for advancing giant-impact theory in the future

- Giant impacts exhibit diverse possible outcomes leading to changes in planetary mass, composition, and thermal history depending on the conditions.
- Improvements to computer simulation methodologies and new laboratory experiments provide critical insights into the detailed outcomes of giant impacts.
- When colliding planets are similar in size, they can merge or escape one another with roughly equal probability, but with different effects on their resulting masses, densities, and orbits.

Different sequences of giant impacts can produce similar planets, encouraging the use of probability theory to evaluate distinct formation hypothesis.

MAGNETIC NANO PARTICLE

Thesis submitted in partial fulfillment of the requirements
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Master Of Science
(M.Sc)

in PHYSICS

By

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ROLLNO: -MSc/Phy/22-013

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KENDRAPARA AUTONOMUS COLLEGE KENDRAPARA

STUDY OF
COLOSSAL MAGNETO RESISTANCE

A PROJECT SUBMITTED TO

KENDRAPADA AUTONOMOUS COLLEGE, KENDRAPADA
IN THE FULFILMINT OF THE REQUIREMENTS FOR THE DEGREE OF
MASTER OF SCIENCE

SUBMITTED BY

SIDDHESWAR SAHOO

Roll No: Msc/phy/22-012

UNDER THE SUPERVISION OF
Sri Anant Ram Panda

ESTD.1959

DEPARTMENT OF PHYSICS
KENDRAPADA AUTONOMOUS COLLEGE, KENDRAPADA

Hareswaraya Mi

ABSTRACT

Colossal magnetoresistance (CMR) is a phenomenon in which the electrical resistance of a material changes significantly in response to an applied magnetic field. This effect is particularly strong in certain types of materials, such as manganites, which exhibit a transition from a high-resistance insulating state to a low-resistance metallic state when subjected to a magnetic field. CMR has important applications in the development of magnetic sensors and data storage devices, as well as in fundamental studies of magnetism and electronic transport in materials.

The perovskite manganite $RE_{1-x}M_xMnO_3$ (RE = La, Pr, Sm, etc. and M = Ca, Sr, Ba, Pb) exhibiting colossal magnetoresistance (CMR) effect is one of strongly correlated electron systems with strong interplays among the charge, spin, orbital, and lattice degrees of freedom, such as double-exchange interaction, super-exchange interaction, Jahn-Taller-type electron-lattice distortion, and Hund's coupling, *etc.*, leading to complex electronic, magnetic, and structural phase diagrams. The rich physics involved in manganites, for example, the phase separation, charge ordering, and half-metallicity, makes it as one of the hottest topics in condensed matter physics, and various prototype devices have been designed with the development of the preparation technology and scientific research. In this review, after a brief introduction on the most important features of crystal structure, electronic structure and phase diagram, most efforts are devoted to the following aspects: CMR effect in single phase manganite related to the field sensitive spine-charge interactions and phase separation; rectifying property and negative/positive magnetoresistance effect in manganite/Nb:STO *p-n* junctions related to the special interface electronic structure; magnetoelectric coupling effect in manganite/ferroelectric structure taking advantage of the strain, carrier density and magnetic field sensitive properties; tunneling magnetoresistance effect in tunnel junctions with dielectric, ferroelectric, and organic semiconductor spacers by using the fully spin polarized nature of manganites; and size effect on magnetic properties in manganite nanoparticles.

THE STUDY OF
"CARBON NANOTUBES AND THEIR APPLICATIONS"

SIDDHESWAR SAHOO

PG 2nd year science physics (Hons)

Exam. Roll No: MSc/Phy/22-012

A PROJECT SUMBITTED TO KENDRAPADA AUTONOMOUS COLLEGE

IN FULFILMENT OF THE REQUIREMENTS FOR THE

MASTER DEGREE OF SCIENCE

UNDER THE SUPERVISION OF

DR. ANANT RAM PANDA

ASST. PROFESSOR OF PHYSICS

Haranya Mis

ABSTRACT

Carbon nanotubes (CNTs) are one of the most intriguing and promising materials of the 21st century. They have a unique set of mechanical, electrical, and thermal properties that make them useful in a wide range of applications, from electronics to materials science. CNTs are one-dimensional cylindrical structures made entirely of carbon atoms, arranged in a hexagonal lattice.

The synthesis of CNTs has been a subject of intense research for over two decades, with several methods developed to produce them in various forms, including single-walled, double-walled, and multi-walled CNTs. The most commonly used methods for CNT synthesis are chemical vapor deposition (CVD), arc discharge, laser ablation, and chemical vapor transport.

CNTs have many exceptional properties that make them ideal for use in various applications. For example, they have high tensile strength, are lightweight, and have high electrical and thermal conductivity. Due to their high aspect ratio, they are also flexible and have a large surface area, making them useful for energy storage and conversion, such as in batteries and supercapacitors.

In the field of electronics, CNTs are of significant interest due to their ability to carry electrical current with minimal resistance. This makes them a potential replacement for conventional metal wires in various applications such as interconnects, field-effect transistors (FETs), and memory devices. Additionally, CNTs have the potential to improve the performance of other electronic devices such as solar cells and sensors.

CNTs also have a unique set of mechanical properties, including high stiffness, elasticity, and toughness. These properties make them useful in the development of high-strength materials, such as composites. Furthermore, their large surface area and high porosity make them useful in applications such as gas adsorption, water filtration, and drug delivery.

Despite their remarkable properties, there are still several challenges in the widespread use of CNTs. The high cost of synthesis and the difficulty in achieving uniformity and purity are significant challenges. Furthermore, their potential toxicity and environmental impact are also concerns that need to be addressed.

In conclusion, CNTs are a highly promising material with a unique set of properties that make them useful in a wide range of applications. Despite the challenges in their synthesis and potential environmental impact, continued research into CNTs is expected to lead to further advances in their use, potentially revolutionizing various fields such as electronics, energy, and materials science.

PROJECT WORK
ON

BLACK HOLE PHYSICS

Submitted by:-

SUSHRISANGITA SINGH

3rd Semester Student

Reg. No. : MSc/phy/22-011

Year : 2022-2024

Under the Supervision of:-

Dr Anantarama panda

DEPARTMENT OF PHYSICS

KENDRAPARA AUTONOMOUS COLLEGE

KENDRAPARA,754211

OLED TECHNOLOGY

Thesis submitted in partial fulfillment of the requirements
For the degree of
Master Of Science
(M. Sc)

in PHYSICS

By

ANANYA DAS

ROLLNO: -MSc/Phy/22-010

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KENDRAPARA AUTONOMUS COLLEGE KENDRAPARA

1. ABSTRACT:

OLED *(Organic Light Emitting Diode)* TECHNOLOGY

OLED is flat light emitting technology, composed of thin films of organic molecules that create light with the application of electricity. OLED can provide displays on electronic devices and use less power than conventional light emitting diodes i.e. (LED) used today.

Like an LED, an OLED is a solid state semiconductor device that is 100 to 500 nanometres thick and 200 times smaller than the human hair. OLED can have two layers or three layers of organic material. It emits light through a process called electrophosphorescene.

An OLED consists of the following parts:

- Anode
- Organic layers
- Cathode

There are Different Types of an OLED are available:

- Active-matrix OLED
- Passive matrix OLED
- Transparent OLED
- Foldable OLED
- Top emitting OLED
- White OLED

Currently OLED are used in many devices such as:

- Display
- Keyboard

"A study on Cosmic Microwave Background Radiations and the temperature fluctuations in CMBR"

Author -Bibhab Ranjan Mohanty,

M.Sc. Physics, Dissertation, 3rd Semester.

Guide - Prof. Anant ram panda

P.G. Department of Physics,

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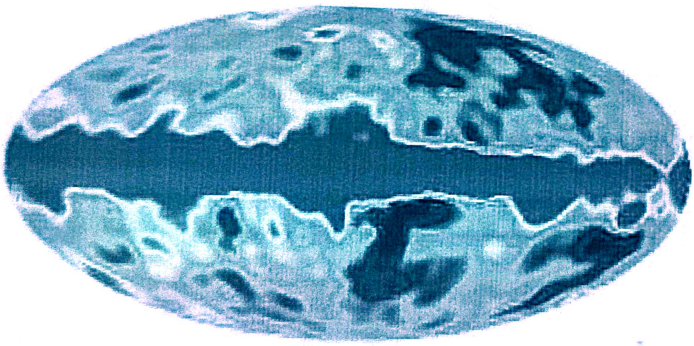

A Study On Cosmic Microwave Background Radiations and the temperature fluctuations in CMBR

Bibhab ranjan mohanty
M.Sc. Physics, 3rd Semester, Dissertation
Department of Physics
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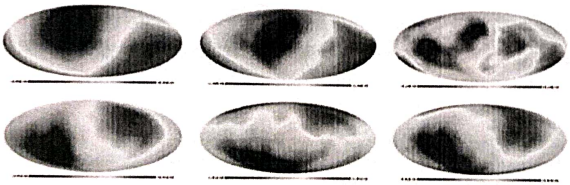
Guide : **Prof. Anant ram Panda**

March 2, 2024

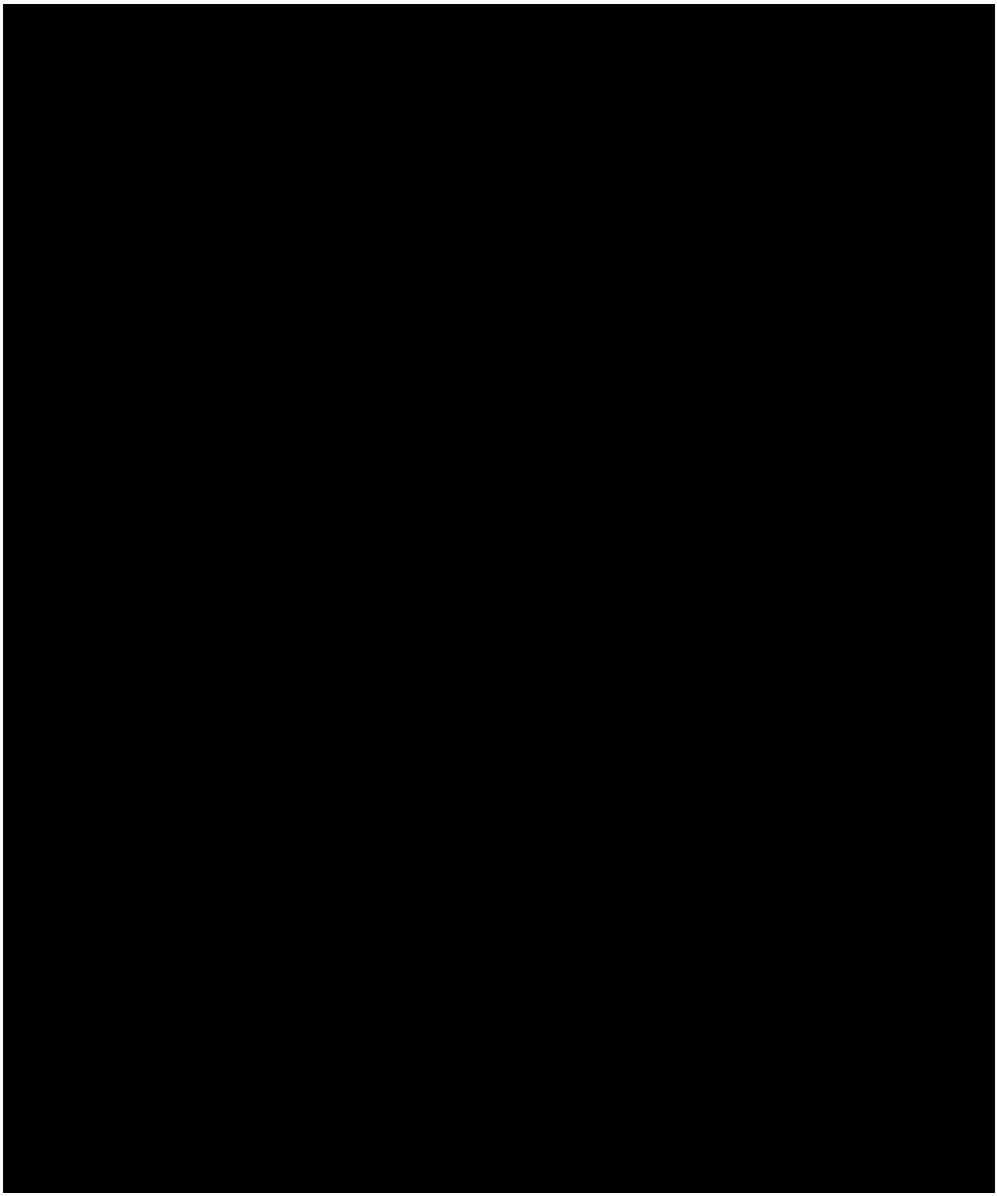
Abstract

Penzias and Wilson (1965) observed a nearly uniform and isotropically distributed microwave radiation noise coming from deep space with a blackbody temperature of about **3K**. This cosmic microwave background (CMB) was quickly identified as the remnant blackbody radiation from the era following the Big Bang. Later, balloon experiments and space-based measurements by the Cosmic Background Explorer (COBE) NASA mission showed that the CMB is extremely uniform and isotropic with an average temperature of
$T_{CMB} = 2.725 \pm 0.002K$; The NASA Wilkinson Microwave Anisotropy Probe (WMAP) mission mapped the angular variation of the CMB temperature *i.e.*$\pm 200\mu K$ CMB temperature variations mapped onto galactic coordinates. The CMB represents the photons that were in thermal equilibrium with the high-temperature plasma that existed from the very first moments of the universe until it cooled down to approximately $3000K$ about 380,000 **years** after the Big Bang. As the temperature fell below $3000K$, the electrons and protons in the plasma combined for the first time into neutral hydrogen atoms, a period that is known rather as **the era of recombination**. After this era of "last scattering" of photons by free electrons, the quantum structure of the atoms prevented them from absorbing radiation except at their narrow spectral frequencies, so the universe became transparent and the blackbody radiation quickly fell out of equilibrium with the neutral atoms.



1 LITERATURE REVIEW

1. 1896 – Charles Edouard Guillaume estimates the "radiation of the stars" to' be 5–6 K.



Abstract

As the hunger of knowledge has no bounds, the study of different material properties has become an essential part of condensed matter physics. The MnO has been a centre of attraction for the material scientists due to its unique electric, magnetic and optical properties. A large number of research papers have addressed the properties and problems associated with the original MnO. Synthesis of MnO nanoparticles were annealed the precursor by, operating under muffle Furnace, have been synthesized with the help of salt such as manganese acetate by using NaOH solution. Vibrational properties were studied by the Structural property was studied by X-ray diffraction method. Optical spectroscopy has confirmed it as a semiconductor with band gap nearly 3.6 eV. Particle size and morphology analysis carried by Scanning Electron Microscopy (SEM) showed that open and semi linear structures. Elemental composition measured by Energy Dispersive Analysis (EDS). Electrical properties shown by LCR.

Doping and co-doping Induced Evolution of Microstructural Properties of ZnO

Thesis submitted in partial fulfillment of the requirements
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Master of Science
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In PHYSICS
By
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KENDRAPARA AUTONOMOUS COLLEGE KENDRAPARA

A PROJECT REPORT ON

ELECTRICAL AND OPTICAL CHARACTERIZATION OF THIN FILM g-C_3N_4

KENDRAPARA AUTONOMOUS COLLEGE,
KENDRAPARA

(SESSION: 2022-24)

GUIDED BY

Dr. ATALA BIHARI PANDA
DEPARTMENT OF PHYSICS
KENDRAPARA AUTONOMOUS COLLEGE, KENDRAPARA

SUBMITTED BY

BALARAM SETHY
Msc/Phy/22-005
SECOND YEAR

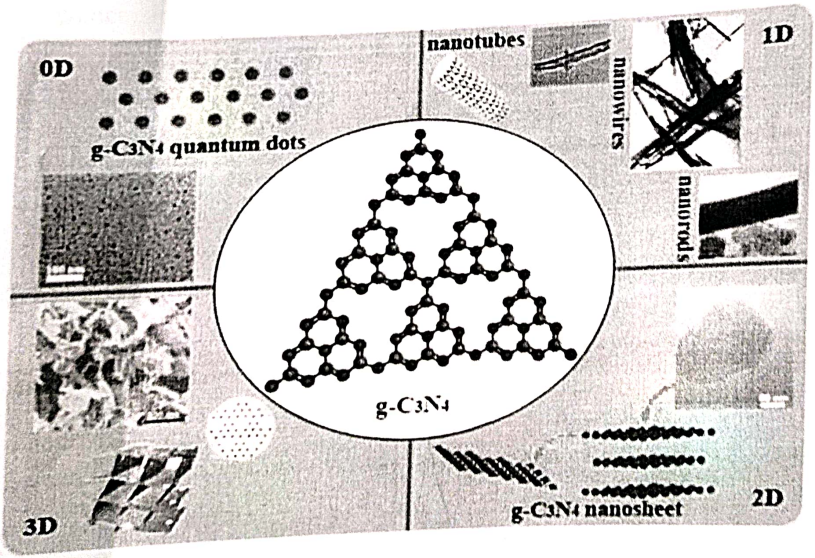
Hiranmaya Mi

Balaram Sethy

1. ABSTRACT:-

Graphitic carbon nitrite(g-C_3N_4) a metal free semiconductor with a band gap of 2.7ev. g-C_3N_4 exhibit high thermal and chemical stability and non toxicity such that it has been considered as the most promising photocatalysts for environmental important and energy conservation.

Hence it is great importance to obtain high quality g-$C_3N_4$and gain a clear understanding of its optical properties.Here in we represent a high yield synthesis of g-C_3N_4products via heating of vaccum sealed urea poweder in crucible at temperature 550C.Using XRD and UV the optical property of g-$C_3N_4$are studied.And by C~V &I~V characteristics we studied the elecrical property g-C_3N_4.



THE QUARK MODEL

SUBMITTED BY-:

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KENDRAPARA AUTONOMOUS COLLEGE

ତମସୋ ମା ଜ୍ୟୋତିର୍ଗମ

ESTD.1959

UNDER THE SUPERVISION

Dr. ANANTA RAM PAND

STUDY OF STRUCTURAL AND DIELECTRIC PROPERTIES OF HAFNIUM DOPED BARIUM TITANATE

A Dissertation submitted for the partial fulfillment of the requirement for the

DEGREE OF MASTER OF SCIENCE

IN MATERIAL SCIENCE

Submitted By

Rajalaxmi Biswal

Roll No.: M.Sc/PHY/22-002

Under the supervision of

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DEPARTMENT OF PHYSICS

KENDRAPARA AUTONOMOUS COLLEGE, KENDRAPARA

SESSION : 2023-24

Abstract

BaHfxTi1−xO3 powders and ceramics with x varying from 0 to 0.15 were prepared via a solid-state reaction technique. Probable reaction pathways were elucidated by employing simultaneous thermogravimetry analysis and differential scanning calorimetry (TGA and DSC). Phase variations in compounds were analysed by X-ray diffraction (XRD). The microstructures and composition of the powders and ceramics were measured and confirmed by SEM images and EDX spectra. Dielectric properties and piezoelectric properties were investigated. The results suggested that the three transitions in BaTiO3 were pinched by substituting titanium with hafnium and the Curie temperatures decreased as the hafnium content rose in the compounds. A high piezoelectric parameter (d33 ~ 305 pC/N) was obtained between the orthorhombic and rhombohedral phases. The effects of hafnium oxide addition and sintering parameters on the structure and dielectric properties of barium titanate were observed. Different percentage of Hfo2 ranging from 0.02 is doped in barium titanate. Both the doped and undoped samples were sintered at temperatures ranging from 1250°C to 1325°C at different soaking times. The amount of densification of the doped and undoped samples is measured in terms of percentage theoretical density. Grain size and microstructural analysis is performed by a scanning electron microscope (SEM). Lattice parameters and tetragonality of doped and undoped barium titanate are calculated from x-ray diffraction pattern obtained from x-ray diffractometer (XRD) test. Dielectric properties of the samples are measured by an impedance analyser. It is found that all the doped samples obtain their maximum percentage theoretical density at a lower sintering temperature compared to the undoped sample. SEM study reveals that the doped samples always show smaller grains compared to the undoped sample. Significant grain growth is observed in all of the samples at sintering temperatures above 1300°C. Correlation among the grain size, tetragonality, and dielectric properties of the doped and undoped samples are also discussed.