DECLARATION

I hereby declare that this thesis entitled "**Metal Oxide-Based Nanostructures: Synthesis, Characterization and Their Applications**" being submitted to the Department of Chemical Sciences, Tezpur University, is a presentation of the original research work carried out by me. Any contribution (text, figure, result or design) of others, wherever involved, is appropriately referenced in order to give credit to the original author(s). All sources of assistance have been duly acknowledged. I affirm that neither this work as a whole nor a part of it has been submitted to any other university or institute for any other degree, diploma or award.

Date: 03/05/2023

Place: Tezpur

Sudakhina Saikia

(Sudakhina Saikia)

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Date:

Place: (**Sudakhina Saikia)**

Dr. Ramesh C. Deka, FRSC
Professor, Department of Chemical Sciences
Tezpur University
Napaam
Tezpur -784028
Assam, India

ড° ৰমেশ চন্দ্ৰ ডেকা, FRSC
অধ্যাপক, ৰসায়ন বিজ্ঞান বিভাগ
তেজপুৰ বিশ্ববিদ্যালয়
নপাম, তেজপুৰ – ৭৮৪০২৮
অসম, ভাৰত

NAAC Grade A+

Phone: 03712-275058 (O); 273639 (R) Fax: 03712-267005; Mobile: 9435380221; E-mail: ramesh@tezu.ernet.in

CERTIFICATE OF THE SUPERVISOR

This is to certify that the thesis entitled "**Metal Oxide-Based Nanostructures: Synthesis, Characterization and Their Applications**" submitted to the School of Sciences, Tezpur University in part fulfillment for the award of the degree of Doctor of Philosophy in Chemical Sciences is a record of research work carried out by **Ms. Sudakhina Saikia** under my supervision and guidance.

All help received by her from various sources have been duly acknowledged.

No part of this thesis has been submitted elsewhere for award of any other degree.

Ramesh Ch. Deka
03/05/2023

(Prof. Ramesh Chandra Deka)

Designation: Professor

School: School of Sciences,

Tezpur University

Department: Chemical Sciences

ACKNOWLEDGEMENT

At the very outset, I extend my utmost gratitude to my supervisor, Prof. Ramesh Ch. Deka, Department of Chemical Sciences, Tezpur University for providing the opportunity to carry out my research work under his supervision. I truly acknowledge him for his invaluable support and for providing the liberty to independently design ideas that boosted my endeavors in the scientific field during my entire research journey.

I express my heartfelt gratitude and regards to Dr. Pangkita Deka, Assistant Professor, Jorhat Engineering College for graciously providing me with guidance, valuable suggestions, and constant help throughout my research period.

I am sincerely grateful to the past and present Vice-Chancellors, Tezpur University for endowing me with the opportunity to be a part of this institution and carry out my research work in a cordial and scientific environment during the stipulated period.

I express my profound gratitude to the past and present Heads, Department of Chemical Sciences, Tezpur University for their valuable help and support in various aspects from time to time. Also, I am immensely thankful to my Doctoral Committee members, Dr. Pankaj Bharali and Dr. Nayanmoni Gogoi, Assistant Professors, Department of Chemical Sciences, Tezpur University for their valuable suggestions and scientific discussions to complete this study.

My deepest regards to Prof. B. M. Choudary (former Director, IICT, Hyderabad), Dr. Thirumalaiswamy Raja (NCL, Pune), Dr. Pranjal Gogoi (NCL, Pune), Dr. Lakshi Saikia (NEIST, Jorhat), Aritra Rajak (IACS, Kolkata) and Rajib Sarkar (NEHU, Shillong) for their constant support and valuable scientific inputs.

I thank all the faculty members and staff of the Department of Chemical Sciences, Tezpur University for their cooperation and help in various ways during my research period.

I gratefully acknowledge the Department of Science and Technology (DST), Government of India for providing DST-INSPIRE Fellowship and Research and Innovation Grant, Tezpur University for research support.

I profoundly thank the reviewers of my manuscripts for their valuable comments and suggestions which greatly helped me to improve my research work.

I convey my heartfelt gratitude and respect to all my teachers from elementary school to post-graduate level for their teachings which in one way or other contributed to shaping my career to this point.

I offer my sincere thanks to my past and present lab mates from both labs, i.e., Catalysis & Molecular Modelling (CMM) lab and Laboratory of Nanocatalysis for Energy and Environment (NEELab) for their help, goodwill and cooperation with me throughout this research journey. My gratitude also goes to the other research scholars of the Department of Chemical Sciences, Tezpur University for their help and encouraging words.

I convey my special thanks to Dr. Rituraj Das, Debabrat Pathak, Anurag Dutta, Dr. Mostofa Ataur Rohman, Dr. John Elisa Kumar, Dr. Kaushik Talukdar and Zumchilo E. Lotha for lending me immense help and support during this research journey.

I especially thank Prof. Ghanashyam Bez (NEHU, Shillong), Dr. Hiranya Saikia (Diphu Govt. College), Prof. Debarshi Prasad Nath (Tezpur University) and Dr. Juri Dutta (Tezpur University) for their valuable suggestions while choosing my research career and for standing beside me like my guardians.

My deepest gratitude goes to my parents, brothers, sister-in-law and other family members for their countless sacrifices, moral support and encouragement in overcoming every hurdle that came across my path.

Last but not the least, I am grateful to everyone who has contributed to the successful realization of my journey, as well as express my apology for not being able to mention personally one by one.

Sudakhina Saikia

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LIST OF SYMBOLS AND ABBREVIATIONS

The symbols and abbreviations used in the thesis are listed below:

Symbols

θ	Theta
°	Degree
α	Alpha
μ	Mu
Å	Angstrom
Ω	Ohm
υ	Nu
β	Beta
λ	Lambda

Abbreviations

AFM	Atomic force microscopy
aq	Aqueous
at.	Atomic
BE	Binding energy
BET	Brunauer-Emmett-Teller
BJH	Barrett-Joyner-Halenda
$^{\circ}C$	Degree celcius
cm	Centimetre
cm^{-1}	Per centimetre
cm^3g^{-1}	Centimetre cube per gram
CR	Congo red
CTAB	Cetyl trimethyl ammonium bromide
DRS	Diffuse reflectance spectroscopy
EDS/EDX	Energy dispersive X-ray spectroscopy
eV	Electron volt
FFT	Fast Fourier transform
FTIR	Fourier transform infrared

FWHM	Full width at half-maximum
g	Gram
gcm^{-3}	Gram per centimeter cube
$gmol^{-1}$	Gram per mole
gL^{-1}	Gram per litre
GO	Graphene oxide
h	Hour
HRTEM	High-resolution transmission electron microscope
IFFT	Inverse fast Fourier transform
IR	Infrared
JCPDS	Joint committee on powder diffraction standards
kV	Kilovolt
L	Litre
LH	Langmuir−Hinshelwood
λ_{max}	$\lambda_{maximum}$
m	Metre
M	Molar
MB	Methylene blue
mg	Milligram
m^2g^{-1}	Metre square per gram
mgL^{-1}	Milligram per litre
μm	Micrometre
MHz	Megahertz
min	Minute
mL	Millilitre
mmol	Millimole
$mmolg^{-1}$	Millimole per gram
mol	Mole
mol^{-1}	Per mole
$molL^{-1}$	Mole per litre
MW	Microwave
nm	Nanometre
No.	Number

NP	Nanoparticle
NS	Nanosheet
Pa	Pascal
ppm	Parts per million
py-FTIR	Pyridine adsorbed Fourier transform infrared
$q_{e,cal}$	$q_{e,calculated}$
$q_{e,exp}$	$q_{e,experimental}$
Ref.	Reference
rGO	Reduced graphene oxide
RhB	Rhodamine B
s	Second
SAED	Selected area electron diffraction
SBA	Santa Barbara Amorphous
SEM	Scanning electron microscope
T	Temperature
t	Time
TEM	Transmission electron microscope
TEOS	Tetraethyl orthosilicate
TGA	Thermogravimetric analysis
UV	Ultraviolet
UV-Vis	Ultraviolet visible
UK	United Kingdom
USA	United States of America
wt	Weight
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction