Dedicated

to

My beloved

Parents & family...

DECLARATION BY THE CANDIDATE

I do hereby declare that the thesis entitled "***Development of stable perovskite based nanocomposites and their fluorometric sensing applications***" is the result of investigations carried out by me in the Department of Chemical Sciences, under the School of Sciences, Tezpur University, India. In keeping with the general practice of reporting scientific opinions, due acknowledgements have been made wherever the work described is based on the findings of other investigators. No part of this thesis has been submitted before for any degree or examination at this or any other university.

Date:

Place: Tezpur University

(**Shahnaz Ahmed)**

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(A Central University established by an Act of Parliament)

CERTIFICATE FROM SUPERVISOR

This is to certify that the thesis entitled "***Development of stable perovskite based nanocomposites and their fluorometric sensing applications***" submitted to the School of Sciences, Tezpur University in partial fulfillment for the award of the degree of Doctor of Philosophy in Chemical Sciences is a record of research work carried out by **Ms. Shahnaz Ahmed** under my supervision and guidance. She has been duly registered (Registration No. TZ189846 of 2018), and the thesis presented is worthy of being considered for Ph.D. Degree.

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.

28.2.24

Date: 28-02-2024

Place: Tezpur University

(**Prof. Swapan Kumar Dolui**)

Supervisor

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CERTIFICATE FROM CO-SUPERVISOR

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Date: (**Prof. Dambarudhar Mohanta**)

Place: Tezpur University Co-Supervisor

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CERTIFICATE OF THE EXTERNAL EXAMINER AND ODEC

This is to certify that the thesis entitled "***Development of stable perovskite based nanocomposites and their fluorometric sensing applications***" submitted by **Ms. Shahnaz Ahmed** to the School of Sciences, Tezpur University in partial fulfillment of the award of the degree of Doctor of Philosophy in the Department of Chemical Sciences has been examined by us on _____ and found to be satisfactory.

The committee recommends for the award of the degree of Doctor of Philosophy.

Supervisor	**Co-Supervisor**	(**External Examiner**)
Name:	Name:	Name:
Date:	Date:	Date:

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Thank You Everyone

Shahnaz Ahmed

ABBREVIATIONS AND SYMBOLS USED

%	Percentage
$(CH_3)_2NH_2^+$	Dimethylammonium
$CH(NH_2)_2^+$	Formamidinium
$CH_3NH_3^+$	Methylammonium
$CH_3NH_3PbX_3$	Methylammonium lead halide
°	Degree
°C	Degree centigrade
Å	Angstrom unit
μ	Octahedral factor
cm^{-1}	per centimetre
$cm^3\ g^{-1}$	cubic centimetre per gram
µl	microliter
µM	micro molar
t	Tolerance factor
a.u.	Arbitrary unit
ACN	Acetonitrile
Al_2O_3	Aluminium oxide
Ala	Alanine
ASV	Anodic stripping voltammetric method
BDC	Benzene dicarboxylic acid
BET	Brunauer-Emmett-Teller
BJH	Barrett–Joyner–Halenda
BTC	Benzene-1,3,5-tricarboxylate
C	Concentration
$Ca(NO_3)_2$	Calcium Nitrate
$CaTiO_3$	Calcium titanate
CB	Conduction bond
CBM	Conduction band maxima
CdS	Cadmium Sulfide
CDs	Carbon Dots

CdSe	Cadmium selenide
CdTe	Cadmium telluride
CPB	Cesium lead bromide
CR	Chemiresistance
$Cr(NO_3)_3$	Chromium Nitrate
Cs	Cesium
$CsPbX_3$	Cesium lead halide
$CsSnX_3$	Cesium tin halide
CsX	Cesium halide
CTAB	Cetyl Trimethyl Ammonium Bromide
Cys	Cysteine
DCM	Dichloromethane
DEA	Diethyl Amine
DEF	N, N- Diethylformamide
DFT	Density Functional Theory
DMF	N, N - Dimethylformamide
DMSO	Dimethyl sulfoxide
DNA	Dinitroaniline
ECL	Electrochemiluminescence
EDA	Ethylene diamine
EDX	Energy dispersive X-ray
EQE	External Quantum Efficiency
ETM	Electron transport material
$EuCl_3$	Europium (III) chloride
eV	Electron volt
FESE	Field emission scanning electron microscopy
FIR	Fluorescence intensity ratio
FL	Fluorescence
FRET	Forster Resonance energy Transfer
FTIR	Fourier transform infrared
FTO	Florine-doped tin oxide
FWHM	Full width half maxima

g	Gram
g/mol	Gram per mole
Glu	Glutamic acid
Gly	Glycine
h	Hour
HI	Hot Injection
HIMDC	4,5- Imidazole dicarboxylic acid
HmIM	Methyl Imidazole
HPLC	High performance liquid chromatography
HRTEM	High resolution Transmission electron Microscopy
HTM	Hole transport material
IFE	Inner Filter Effect
InP	Indium phosphide
K	Kelvin
K_{sv}	Stern Volmer Constant
$LaAlO_3$	Lanthanum aluminate
LARP	Ligand assisted reprecipitation
LC-MS	Liquid-chromatography-mass spectrometry
LED	Light Emitting Diode
LHP	Lead Halide Perovskites
LOD	Limit of detection
LUMO	Lowest unoccupied molecular orbital
m^2g^{-1}	meter square per gram
MA	Methyl Amine
$MAPbX_3$	Methyl ammonium lead halide
MHP	Metal Halide perovskites
min	Minutes
mL	millilitre
mmol	milli mole
MOF	Metal Organic Framework
N/A	Not applicable
NA	Nitroaniline

NAC	Nitro Aromatic Compounds
NC	Nano crystal
$Ni(NO_3)_2$	Nickel Nitrate
nM	nano molar
nm	Nano meter
NMP	N-Methyl Pyrrolidone
ns	nano second
OA	Oleic acid
OAm	Octylamine
OAm	Oleyl amine
ODE	Octadecene
PbS	Lead (II) sulfide
PbSe	Lead (II) selenide
PCE	Photoconversion efficiency
PDMS	Polydimethylsiloxane
PEC	Photo-electrochemistry
PeNCs	Perovskite nanocrystals
PeQDs	Perovskite quantum dots
PL	Photoluminescence
PLE	Photoluminescence emission
PLQY	Photo luminescence quantum yield
PMMA	Polymethyl methacrylate
p-NP	p-nitrophenol
ppb	Part per billion
P-Phe	Phenylene diamine
ppm	Parts per million
PS	Polystyrene
PTFE	Polytetrafluoroethylene Membrane
PV	Photovoltaic
PVDF	Polyvinylidene Fluoride
PXRD	Powder X-Ray diffraction
QDs	Quantum dots

QE	Quenching efficiency
Rb	Rubidium
rGO	Reduced graphene oxide
RhB	Rhodamine Blue
RSD	Relative Standard Deviation
SEM	Scanning electron microscopy
Ser	Serine
SiO_2	Silicon dioxide
TAS	Transient Absorption Spectroscopy
$TBAP_6$	Tributylammonium hexafluorophosphate
TEA	Triethylamine
TEM	Transmission electron Microscopy
TEM	Transmission electron microscopy
TGA	Thermogravimetric analysis
THF	Tetra hydro furan
TiO_2	Titanium dioxide
TMB	1,3,5-trimethylbenzene
TNT	Trinitrotoluene
TOPO	Tri-octyl phosphine
TRPL	Time resolved photoluminescence spectroscopy
UV	Ultraviolet
VB	Valence band
VBM	Valence band maxima
VOC	Volatile organic compound
wt%	weight percentage
XPS	X-ray photoelectron spectroscopy
XRD	X-ray diffraction
ZIF-8	Zeolitic Imidazolate Framework
$Zn(NO_3)_2$	Zinc Nitrate
Zn-HIMDC	Zinc (II) imidazole-4,5-dicarboxylate
$ZrCl_4$	Zirconium (IV) chloride

LIST OF TABLES

LIST OF SCHEMES