Dedicate this thesis to my beloved parents

and inspiration

Maa & Deuta

DECLARATION BY THE CANDIDATE

I hereby declare that the thesis "***Electrochemical investigations on polymer based ternary nanocomposites, exfoliated MAX phase (Ti_3AlC_2) and lithium iron phosphate***", being submitted to **Department of Physics, Tezpur University**, Tezpur, Assam in partial fulfillment for the award of the degree of Doctor of Philosophy in physics and it has not been previously considered for the award of any degree, diploma, associateship, fellowship or any other similar title or recognition from any University, Institute or other organizations.

Date: 01.06.2023

Place: Tezpur

Devalina Sarmah.

(Devalina Sarmah)

Enrollment No: PHP17005

Registration Number: TZ121548 of 2012

TEZPUR UNIVERSITY

(A Central University established by an Act of Parliament)

Napaam, Tezpur- 784028

DISTRICT: SONITPUR, ASSAM, INDIA

Dr. Shyamal Kumar Das
Assistant Professor
Department of Physics
School of Sciences, Tezpur University

Phone: 03712-275586
Email: skdas@tezu.emet.in

CERTIFICATE OF THE SUPERVISOR

This is to certify that the thesis entitled ***"Electrochemical investigations on polymer based ternary nanocomposites, exfoliated MAX phase (Ti_3AlC_2) and lithium iron phosphate"*** submitted to the School of Sciences, Tezpur University in requirement of partial fulfillment for the award of the degree of Doctor of Philosophy in Physics is a record of research work carried out by **Ms. Devalina Sarmah** 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 degree.

Shyamal Kr Das.

Date: 01.06.2023

Place: Tezpur

(Shyamal Kumar Das)

Principal Supervisor

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Devalina Sarmah

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ABBREVIATIONS

Abbreviations/ Symbol	Name
PPyNTs	Polypyrrole nanotubes
PEDOT	Poly(3,4-ethylenedioxythiophene)
FESEM	Field Emission Scanning Electron Microscopy
FTIR	Fourier-transform infrared spectroscopy
XRD	X-ray diffraction
XPS	X-ray photoelectron spectroscopy
HRTEM	High Resolution Transmission Electron Microscopy
ITO	Indium tin oxide
IUAC	Inter University Accelerator Centre
MeV	Mega electron volt
cm	Centimeter
MO	Methyl orange
CTAB	Cetrimonium bromide
rGO	Reduced graphene oxide
DD water	Double distilled water
NMP	N-Methyl-2-pyrrolidone
PVDF	Polyvinylidene fluoride
SEM	Scanning Electron Microscopy
TGA	Thermogravimetric analysis
TMDC	Transition-metal dichalcogenide
w.r.t	With respect to
g/l	Gram per litre
BET	Brunaur-Emmett-Teller
EDL	Electric double layer
EIS	Electrochemical impedance spectroscopy
MHz	Megahertz
%	Percent
AIB	Aluminum ion battery
Al^{3+} ion	Aluminum ion
A/g	Ampere per gram
CV	Cyclic voltammetry

GCD	Galvanostatic charge-discharge
Ti_3AlC_2	Titanium Aluminum Carbide
$LiFePO_4$	Lithium Iron phosphate
h	hour
M	Molar
mA	Mili ampere
MoS_2	Molybdenum disulfide
NaOH	Sodium Hydroxide
KCl	Potassium chloride
GO	Graphene oxide
$AlCl_3$	Aluminium chloride
$Al_2(SO4)_3$	Aluminium sulfate
$Al(NO_3)_3$	Aluminium nitrate
^oC	Degree Celsius
Wh	Watt-hour
Ω	Ohm
η	Coulombic efficiency
C_{sp}	Specific capacitance
R_s	Equivalent series resistance
R_{ct}	Charge transfer resistance
S_e	Electronic energy loss
S_n	Nuclear energy loss