

*I dedicate this thesis in the memory of my beloved
late. Grandfather (Dadu)*

DECLARATION

I hereby declare that the thesis “*Investigation on electroactive materials for rechargeable aqueous aluminum-metal/ion battery*” being submitted to the **Department of Physics, Tezpur University** under the School of Sciences in partial fulfillment for the award of the degree of Doctor of Philosophy in Physics. This is an original work carried out by me and it has not been previously considered for the award of any degree, diploma, associateship, fellowship or and other similar title or recognition from any University, Institute or other organization.

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(संसदकेअवधवनयम द्वारा स्थावपत केँ विश्वविद्यालयद्रीय)

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CERTIFICATE OF THE PRINCIPAL SUPERVISOR

This is to certify that the thesis entitled “*Investigation on electroactive materials for rechargeable aqueous aluminum-metal/ion battery*” submitted to the School of Sciences, Tezpur University in partial fulfillment for the award of the degree of Doctor of Philosophy in **Department of Physics** is a record of original research work carried out by **Sunny Nandi** under my personal supervision and guidance.

All helps received by him from various sources have been duly acknowledged.

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

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CERTIFICATE OF THE EXTERNAL EXAMINER AND ODEC

This is to certify that the thesis entitled “*Investigation on electroactive materials for rechargeable aqueous aluminum-metal/ion battery*” submitted by Sunny Nandi to Tezpur University in the Department of Physics under the School of Sciences in partial fulfillment of the requirement for the award of the degree of Doctor of Philosophy in Physics has been examined by us on _____ and found to be satisfactory.

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

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ACKNOWLEDGEMENTS

First to begin with, I would like to express my sincere gratitude to my supervisor Dr. Shyamal Kumar Das, who was the driving force behind my decision to pursue my PhD at Tezpur University. His advice, leadership, and support helped me to learn a lot. I appreciate the opportunities he has given to me, his unwavering patience, pleasant demeanour, and most importantly the fact that despite his busy schedule, he is always available whenever I need him, whether it be via email or in person. I am excited about my future as a scientist, and I will always be grateful to him for that.

I want to convey my sincere gratitude to Professor Gazi Ameen Ahmed and Dr. Rajib Biswas of the doctorate committee for their support and encouragement during my PhD tenure.

I want to express my gratitude to Prof. Vinod Kumar Jain, former Vice Chancellor of Tezpur University, for providing all the facilities I needed on the university campus to conduct my research.

I am really grateful to Prof. Mrinal Kumar Das, Head of the Physics Department, Nilakshi Das former Head of the Physics Department, for all the kind assistance and support throughout my PhD course in the Department. I am also thankful to the entire faculty of the Department of Physics for their helpful assistance and supports during my PhD study.

I would also like to thank to the Dean, School of Sciences, Tezpur University for the academic support and generosity.

I am always thankful to the technical and non-technical staff members of Department of Physics and SAIC, Tezpur University: Mr. Palash Dutta, Mr. Biju Boro, Mr. Prakash Kurmi, Mr. Tridib Ranjan Nath, Mr. Nava Kr. Gogoi, Mr. Mohendra Das, Mr. Narayan Sharma, Mr. Dhruba Deka, and Mr. Umesh Patir.

I am thankful to my funding agency Science & Engineering Research Board (SERB), Department of Science and Technology, Govt. of India for proving me the fellowship during my PhD course.

I want to sincerely thank Dr. Yuzhang Li, Department of Chemical and Biomolecular Engineering and Prof. Ximin He, Department of Materials Science and Engineering at University of California, Los Angeles, United States, for all their help with my research objectives during my Fulbright Stay.

I also acknowledge United States-India Educational Education (USIEF) and Institute of International Education (IIE) for enabling me to stay at University of California, Los Angeles (UCLA), United States under the Fulbright Nehru Doctoral Research Fellowship (2021-2022).

Many thanks to my lab mates- Homen Lahan, Devalina Sarmah, Ritupurna Baishya, Atowar Rahman and Konica Roy who gave me a lot of help in my primary research studies.

To all my colleagues at Tezpur University, thanks to Panchali and Bikash Thapa for being with me all during all the important millstones of my PhD course. Thanks to Kashmiri, Sritam and Ankush for guiding me throughout my PhD. Thanks, Kakoli and Sita for your help during my pre-thesis completion. Thanks, Honey di, Gayatri di, Adity, Saswati, Trinakshee and Rahul Sarma for all the care and guidance during my stay at Tezpur University. Thank you all for making my PhD journey unforgettable.

To my other colleagues and friends at University of California, Los Angeles- Thanks, Jinhui, Yichen, Freya, Srinath, Diplav, Gaurav, Hamid and Rahul Bhaiya for making my stay more comfortable and memorable ones. Thanks, Anirban for guiding me and treating me like your own brother.

Last but not the least, I couldn't have done it without the love and support of my family members- Dida, Babu, Maa and Borda, they all have provided me with unending support, prayers, love and advice.

Sunny Nandi

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CHAPTER 6 (Part II): Reversible Al³⁺ ion storage in lithium manganese

Phosphate (LiMnPO₄) for aqueous electrolyte

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LIST OF ABBREVIATIONS AND SYMBOLS

Abbreviation/Symbol	Name
%	: Percent
LIB	: Lithium-ion battery
AIB	: Aluminum ion battery
Al	: Aluminum
Al ³⁺ ion	: Aluminum ion
Ca	: Calcium
cm	: Centimetre
Cu	: Copper
Conc.	: Concentration
mg	: Milligram
Li	: Lithium
Na	: Sodium
K	: Potassium
Zn	: Zinc
Mg	: Magnesium
Ca	: Calcium
CV	: Cyclic voltammetry
γ	: Gamma
g/l	: Gram per litre
min	: Minute
ml	: Millilitre
mA	: Milliampere
V	: Voltage
Å	: Angstrom
h	: hour
PVDF	: Polyvinylidene fluoride
NMP	: N-Methyl-2-pyrrolidone
BET	: Brunaur-Emmett-Teller
mM	: Millimolar
TGA	: Thermogravimetric analysis

Mg	:	Magnesium
XRD	:	X-ray diffraction
TMDC	:	Transition-metal dichalcogenide
mHz	:	Megahertz
kHz	:	Kilohertz
w.r.t.	:	with respect to
nm	:	Nanometre
μm	:	Micrometre
Ag^{-1}	:	Ampere per gram
$^{\circ}\text{C}$:	Degree Celsius
Ω	:	Ohm
R_{ct}	:	Charge transfer resistance
Bi_2O_3	:	Bismuth oxide
BiOCl	:	Bismuth oxychloride
VEG	:	Vanadyl ethylene glycolate
MoTe_2	:	Molybdenum ditelluride
LiMn_2O_4	:	Lithium manganese oxide
LiMnPO_4	:	Lithium manganese phosphate
SHE	:	Standard Hydrogen Electrode
Wh	:	Watt-hour
$\text{Al}(\text{CF}_3\text{SO}_3)_3$:	Aluminum trifluoromethanesulfonate