

DECLARATION

The thesis entitled “**Studies on conducting metal organic framework (MOF) based electrode material for efficient electrochemical sensing and biosensing applications**” being submitted to the Department of Physics, Tezpur University, Tezpur, Assam in partial fulfilment for the award of the degree of Doctor of Philosophy in Physics is a record of bona fide research work accomplished by me under the supervision and guidance of Prof. D. Mohanta.

All help received from various sources has been duly acknowledged. No part of this thesis has been submitted elsewhere for the award of any other degree.



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Date: 11-09-2024

Place: Tezpur

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CERTIFICATE OF THE SUPERVISOR

This is to certify that the thesis entitled “*Studies on conducting metal organic framework (MOF) based electrode material for efficient electrochemical sensing and biosensing applications*” submitted to the Department of Physics, **School of Sciences, Tezpur University** in partial fulfilment for the award of the degree of Doctor of Philosophy in Physics, is a record research work carried out by **Kakoli Doloi** under my supervision and guidance.

All help received by her from various sources has been duly acknowledge. No part of this thesis has been submitted elsewhere for the award of any other degree.

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*Dedicated to my beloved Maa-Deta
and Nu*

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List of abbreviations

Ag ₂ O	:	silver oxide
BDC	:	1,4-benzenedicarboxylate
BET	:	Brunauer-Emmet-Teller
BJH	:	Barrett–Joyner–Halenda
CP	:	Conducting Polymers
CT	:	Catechol
Cd	:	Cadmium
CV	:	Cyclic voltammetry
DPV	:	Differential pulse voltammetry
DPSV	:	Differential pulse stripping voltammetry
EDX	:	energy dispersive x-ray
EIS	:	Electrochemical impedance spectroscopy (EIS)
FT-IR	:	Fourier Transform Infrared Spectroscopy
H ₂ NDC	:	2,6-naphthalenedicarboxylic acid
Hg	:	Mercury
HK	:	Horvath–Kawazoe
HRTEM	:	High resolution transmission electron microscopy
HQ	:	Hydroquinone
ICMOF	:	Intrinsically Conducting MOF
IgG	:	Immunoglobulins G
ITO	:	Indium Tin Oxide
IRMOF	:	Isorecticular MOF
I-V	:	Current-Voltage
LOD	:	Limit of detection
MOF	:	Metal Organic Framework
MIL	:	Materials Institute Lavoisier ZIF-series
MONPs	:	metal oxide nanoparticles
MNP	:	Metal Nanoparticles
NC	:	Nanoclusters
PANI	:	Polyaniline
PPy	:	Polypyrrole
PEDOT	:	Poly(3,4-ethylenedioxythiophene)
PBS	:	phosphate buffer saline
SBU	:	Secondary Building Unit
SEM	:	Scanning electron microscopy
SAED	:	Selected Area Electron Diffraction
SHI	:	Swift Heavy Ion
TLM	:	Transfer length method
TBS	:	tris buffer saline
UiO-66	:	University of Oslo-66
XRD	:	X-ray diffraction
ZIF	:	Zeolitic imidazolate frameworks

List of symbols

β	:	Full width half Maxima
θ	:	Bragg's angle
v	:	Volume
σ	:	Conductivity
\AA	:	Angstrom
ν	:	Scan-rate
λ	:	wavelength
S_{BET}	:	BET surface area
G	:	Conductance
q	:	Electronic charge
k	:	Boltzmann constant
l	:	Probe separation
I_{pa}	:	anodic peak current
I_{pc}	:	cathodic peak current
ΔE_p	:	peak-to-peak separation
T	:	Absolute temperature
η	:	Ideality Factor
V	:	Potential
I	:	Current
n	:	Carrier concentration
β	:	dielectric constant
R_{ct}	:	Charge Transfer Resistance
W	:	Warburg impedance
C_{dl}	:	Electric double layer capacitance
A	:	Electroactive surface area
m	:	Slope
C^o	:	Concentration of the analytes
D_o	:	Diffusion coefficient