

Declaration

This is to certify that the thesis titled *Advanced and Emerging Materials for Energy, Environmental and Magnetic Applications* submitted by Bhagirath Saini to the Indian Institute of Technology Jodhpur for the award of the degree of *Doctor of Philosophy* is a bonafide record of the research work done by him under our supervision. To the best of our knowledge the contents of this report, in full or in parts, have not been submitted to any other institute or university for the award of any degree or diploma.



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Declaration

I hereby declare that the work presented in this Thesis titled "*Advanced and Emerging Materials for Energy, Environmental and Magnetic Applications*" submitted to the Indian Institute of Technology Jodhpur in partial fulfilment of the requirements for the award of the degree of Doctor of Philosophy, is a bonafide record of the research work carried out under the supervision of Prof. Rakesh Kumar Sharma and Co-supervision of Dr. Rahul Singhal. The contents of this thesis in full or in parts, have not been submitted to, and will not be submitted by me to, any other Institute or University in India or abroad for the award of any degree or diploma.



Bhagirath Saini

P18CY002

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Bhagirath Saini
Ph.D. Student

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List of Symbols

Symbol	Description
α	Alpha
β	Beta
π	Pie
$\text{\AA}$	Angstrom
K_{app}	Apparent reaction rate constant at time t
R^2	linear regression coefficient
C=O	Carbonyl group
e^-	Electron
h^+	Hole
λ_{max}	Maximum wavelength
pH	Potential of hydrogen
λ_{em}	Emission wavelength
λ_{ex}	Excitation wavelength
C_{SC}	Chemical capacitance
T_{N}	Neel temperature
Ω	ohm
θ	Theta
C_{T}	Electrolyte capacitance
$-\text{NH}_2$	Amino group
μm	Micrometers
cm	centimeter
mm	Millimeter
nm	Nanometer
μM	Micromolar
mM	Millimolar
mV	Millivolt
mA	Milliampere
dec	Decade
%	Percentage
Wt. %	Weight percentage
$-\text{OH}$	Hydroxyl group
$-\text{O}-\text{CH}_3$	Methoxy group
O^{2*-}	Superoxide radical anions
cm	Centimeters
$^{\circ}\text{C}$	Degree celsius
C_0	initial concentration
HCl	Hydrogen chloride
n	Binding parameter
μL	Microliters
mL	Milliliter
Hz	Hertz
V	Voltage
eV	electron volt
M	Molarity
N	Normality
KOH	Potassium hydroxide
KHz	kilohertz
Hz	hertz
iR	internal resistance
R_{s}	Series resistance
R_{ct}	Charge transport resistance
C_{s}	Specific capacitances
C_{dl}	double-layer capacitance

List of Abbreviations

a.u.	Arbitrary Unit
B.E.	Binding Energy
BET	Brauner Emmett Teller
BJH	Barrett Joyner Halenda
CB	Conduction band
cc	cubic centimeter
CE	Counter Electrode
CIF	Ciprofloxacin
CPE	Constant Phase Element
CR	Cresol Red
CS	Carbon sphere
CV	Cyclic Voltammetry
DCX	Decarboxylation
DCN	Decarbonylation
DCO ₂	Decarboxylation
DFT	Density functional theory
DI	De-ionized
DRS	Diffuse Reflectance Spectra
ECSA	Electrochemically active surface area
EDTA	Ethylenediaminetetraacetic acid
EIS	Electrochemical Impedance Spectroscopy
EPR	Electron spin resonance
FAME	Fatty acid methyl esters
FCC	Face Centered Cubic
FE-SEM	Field Emission Scanning Electron Microscope
FWHM	Full Width Half Maximum
GC	Gas chromatography
HDO	Hydrodeoxygenation
HER	Hydrogen Evolution Reaction
HF	Hydrofluoric
HOMO	Highest Occupied Molecular Orbital
HRMS	High-Resolution Mass Spectroscopy
HR-TEM	High Resolution Transmission Electron Microscope
IBP	Ibuprofen
ICDD	International Centre for Diffraction Data
JCPDS	Joint Committee on Powder Diffraction Standards
LMO	Lithium Manganese Oxide
LUMO	Lowest Unoccupied Molecular Orbital
MB	Methylene blue
MO	Methyl orange
MOFs	Metal-organic frameworks
MX	MXene
NMR	Nuclear magnetic resonance spectroscopy
PL	Photoluminescence Spectroscopy
rpm	Revolution per minute
RHE	Reversible Hydrogen Electrode
SAED	Selected Area Electron Diffraction
TEM	Transmission electron microscopy
TGA	Thermal Gravimetric Analysis
TPD	Temperature Programmed Desorption
UV-vis	Ultraviolet-Visible Spectroscopy
VB	Valence band
XRD	X-ray Diffraction
XPS	X-ray Photoelectron Spectroscopy

