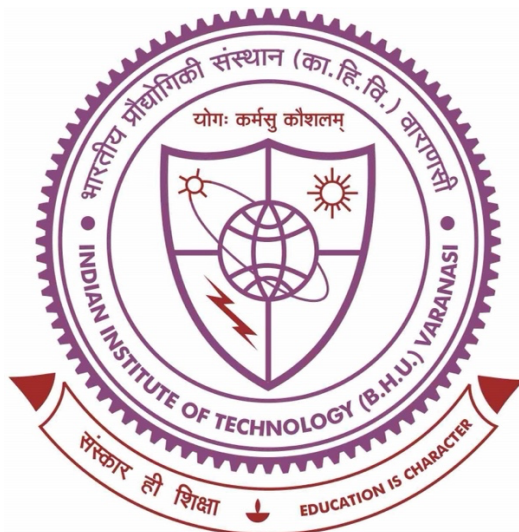


Development of Transition Metal Containing Phosphate Based Pseudocapacitive Electrodes for the Fabrication of High Performing Hybrid Supercapacitors



**A thesis submitted in partial fulfillment for the
Award of Degree**

Doctor of Philosophy

By

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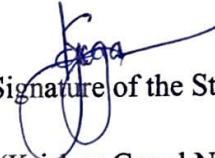
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List of Abbreviations

XRD	X-ray Diffraction
HR	SEM-High-Resolution Scanning Electron Microscope
HR-TEM	High-Resolution Transmission Electron Microscope
TGA	Thermogravimetric analysis
FTIR	Fourier transform Infrared Spectroscopy
XPS	X-ray Photoelectron Spectroscopy
BET	Brunauer, Emmett, and Teller
CV	Cyclic Voltammetry
ASCs	Asymmetric Supercapacitors
HSCs	Hybrid Supercapacitors
EDLC	Electrochemical double layer capacitor
EIS	Electrochemical impedance spectroscopy
ES	Electrochemical supercapacitor
C_{sp}	Specific capacitance
A, mA (unit)	Ampere, milliamp
AC	Activated Carbon
AM	Active mass
C, μC (unit)	Coulomb, microcoulomb
C	Capacitance
C^{+}/R^{+}	Cationic species in electrolyte
C^*	Complex differential capacitance
C_{+ve}	Capacitance of positive electrode
C_{-ve}	Capacitance of negative electrode
C_{Cell}	Overall cell capacitance
C_{Diff}	Capacitance from diffuse layer
C_{dl}	Capacitance from double layer
C_g	Gravimetric capacitance
C_H	Capacitance from Helmholtz plane
C_{IH}	Capacitance from inner Helmholtz plane
C_{OH}	Capacitance from outer Helmholtz plane
e-	Electron
ϵ	Permittivity of vacuum
E	Electrode potential

E°	Standard electrode potential
E_{Total}	Total energy stored in capacitor
f	Frequency
F	Faraday constant
$F, \text{mF}, \mu\text{F}(\text{unit})$	Farad, millifarad, microfarad
$g, \text{mg}, \mu\text{g}(\text{unit})$	Gram, milligram, microgram
$h (\text{unit})$	Hour
$\text{Hz}, \text{mHz}, \text{kHz} (\text{unit})$	Hertz, millihertz, kilohertz
I	Current
$K (\text{unit})$	Temperature in Kelvin
K	Boltzmann's constant
M	Mass of active materials
$m, \text{cm}, \mu\text{m}, \text{nm} (\text{unit})$	Meter, centimeter, micrometer, nanometer
M	Molar concentration
Q	Charge stored
V	Voltage
V_{max}	Maximum voltage
V_{Min}	Minimum voltage
$W (\text{unit})$	Watt
$\text{Wh} (\text{unit})$	Watt hour
$\text{wt}\%$	Weight percentage
ω	Angular frequency
X	Fraction of ion occupancy in lattice
z	Number of electrons transferred in redox reactions
Z^*	Total impedance
Z'	Real component of impedance
Z''	Imaginary component of impedance
ΔV	Voltage window
$^\circ\text{C} (\text{unit})$	Temperature in Celsius
θ_{H}	Surface coverage of H^+ in underpotential deposition