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I, **MANISH KUMAR** (Roll No. 16171005), certify that the work embodied in this thesis is my own bonafide work and carried out by me under the supervision of **PROF. PRABHAKAR SINGH** from **JULY, 2016** to **FEBRUARY, 2022** at the **DEPARTMENT OF PHYSICS**, Indian Institute of Technology, Varanasi. The matter embodied in this thesis has not been submitted for the award of any other degree/diploma. I declare that I have faithfully acknowledged and given credits to the research workers wherever their works have been cited in my work in this thesis. I further declare that I have not willfully copied from any other's work, paragraphs, text, data, results, *etc.*, reported in journals, books, magazines, reports, dissertations, theses, *etc.*, or available at websites and have not included them in this thesis and have not cited as my own work.

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LIST OF SYMBOLS AND ABBREVIATIONS

PV	Photovoltaics
VB	Valence Band
CB	Conduction band
I_{sc}	Short Circuit Current
J_{sc}	Current Density
V_{oc}	Open Circuit Voltage
P	Power
P_{max}	Maximum Power Output
P_{in}	Power Incident
FF	Fill Factor
PCE (η)	Power Conversion Efficiency
R_s	Series Resistance
R_{sh}	Shunt Resistance
I-V	Current – Voltage
I_0	Reverse Saturation Current
I_L	Photo-generated Current
I_m	Maximum Current
V_m	Maximum Voltage
AM	Air Mass
DSSC	Dye-Sensitized Solar Cell
PSC	Perovskite Solar Cell
IPCE	Incident Photon to Current Conversion
MA	Methyl ammonium
FA	Formamidinium

ETL	Electron Transport Layer
ETM	Electron Transport Material
HTL	Hole Transport Layer
HTM	Hole Transport Material
SCLC	Space Charge Limited Current
FTO	Fluorine-doped Tin Oxide
EDX	Energy Dispersive X-Ray Analysis
E_g	Band Gap
$h\nu$	Photon Energy
E_u	Urbach Energy
CBM	Conduction Band Minimum
VBM	Valence Band Maximum
eV	Electron volt
meV	Mili electron Volt
FWHM	Full width at half maximum
g	Gram
K	Kelvin
M.P.	Melting Point
ICDD	International Center for Diffraction Data
JCPDS	Joint Committee on Powder Diffraction Standards
LED	Light Emitting Diode
ΔG	Gibbs Free Energy
ΔS	Entropy
ΔH	Enthalpy
RT	Room Temperature
Å	Angstrom
mg	Milligram

N	Avogadro's number
cm	Centimeter
μm	Micro-meter
W/m^2	Watt per meter square
mV	millivolt
nm	Nanometer
NPs	Nanoparticles
SSR	Solid State Reaction
SEM	Scanning Electron microscope
XPS	X-Ray Photoelectron Spectroscopy
UV-Vis	Ultraviolet-Visible
DSC	Differential Scanning Calorimetric
XRD	X-ray Diffraction
DMF	Dimethylformamide
DI	Deionized
PLD	Pulsed Laser Deposition
RP	Ruddlesden-Popper