Contents

Chapter 6: Conclusion and future scope

Abbreviations used in the thesis

AMBImI	1-(2-acryloyloxy-ethyl)-3-methyl-benzoimidazol-1-ium iodide
AM1.5	Air mass 1.5
–CHO	Aldehyde group
3AT	3-Alkylthiophene
C_nTAB	Alkyl trimethyl ammonium bromide
Al	Aluminium
AZO	Aluminium doped zinc oxide
$-NH_2$	Amino group
CH_3COONH_4	Ammonium acetate
NH_4I	Ammonium iodide
a-Si	Amorphous silicon
AAO	Anodic aluminium oxide
aq	Aqueous
AR	Aspect ratio
AIBN	2,2′-azo-bis-isobutyrylnitrile
BPO	Benzoyl peroxide
bis-PCBM	Bisadduct analogue of [60]PCBM
BHJ	Bulk heterojunction
BMII	Butyl-methyl imidazolium iodide
BMImI	1-Butyl-3-methylimidazolium iodide
CdS	Cadmium sulfide
CdTe	Cadmium telluride
COOH-MWCNT	Carboxy functionalized multiwalled carbon nanotube
-COOH	Carboxyl
CMC	Carboxymethyl cellulose
$C_{16}PC$	Cetylpyridinium chloride

CTA^+	Cetyltrimethylammonum ion
CTAB	Cetyl trimethyl ammonium bromide
CT	Charge transfer
CVD	Chemical vapour deposition
$HAuCl_4$	Chloroauric acid
N3	cis-Bis(isothiocyanato) bis(2,2'-bipyridyl-4,4'-dicarboxylato ruthenium(II)
CB	Conduction band
CIGS	Copper indium gallium selenide
CuK_α	Copper-K_α X-ray radiation
CuSCN	Copper(I) thiocyanate
CN-HPC	Cyanoethylated hydroxypropyl cellulose
CV	Cyclic voltammetry
DSC	Differential scanning calorimetry
DTG	Differential thermogram
N719	di-Tetrabutylammonium-cis-bis(isothiocyanato)bis(2,2'-bipyridyl-4,4'-dicarboxylato) ruthenium(II)
DWCNT	Double walled carbon nanotube
DSSCs	Dye sensitized solar cells
EDX	Energy dispersive X-ray spectroscopy
EC	Ethylene carbonate
EMIM Ac	1-Ethyl-3-methylimidazolium acetate
D*	Excited state of dye
EQE	External quantum efficiency
$FeCl_3$	Ferric chloride
FF	Fill factor
FTO	Fluorine doped tin oxide
FT-IR	Fourier transform infra-red

C_{60}	Fullerene
GHEs	Gelatin hydrogel electrolytes
Au	Gold
D	Ground state of dye
C_6DMII	1-Hexyl-2,3-dimethylimidazolium iodide
HOMO	Highest occupied molecular orbital
HTL	Hole-transporting layer
-OH	Hydroxyl
ICBA	Indene-C_{60} bisadduct
ITO	Indium tin oxide
I^-/I_3^-	Iodide/triiodide
I_2	Iodine
LiI	Lithium iodide
$LiClO_4$	Lithium perchlorate
$LiBF_4$	Lithium tetrafluoroborate
LSPR	Localized surface plasmon resonance
LUMO	Lowest unoccupied molecular orbital
MOCVD	Metal organic chemical vapour deposition
MPN	3-Methoxypropionitrile
MHII	1-Methyl-3-hexylimidazolium iodide
MPII	1-Methyl-3-propylimidazolium iodide
NMP	N-methyl 2-pyrrolidone
MFC	Microfibrillated cellulose
MWCNT	Multiwalled carbon nanotube
NC	Nanocrystal
NP	Nanoparticle
NR	Nanorod

NS	Nanosphere
NT	Nanotube
NW	Nanowire
Zn_i	Neutral zinc interstitial
V_{Zn}^{0}	Neutral zinc vacancy
N_2	Nitrogen
3OT	3-Octylthiophene
1-D	One dimensional
V_{oc}	Open circuit voltage
$PC_{60}BM$	Phenyl-C_{60}-butyric-acid-methyl ester
PCBM	[6,6]-Phenyl-C_{61}-butyric-acid-methyl ester
$PC_{70}BM$	Phenyl-C_{70}-butyric-acid-methyl ester
P-Ru dye	Phosphonated ruthenium polypyridyl dye
PCE	Photo conversion efficiency
PL	Photoluminescence
PV	Photovoltaic
Pt	Platinum
PAA	Poly(acrylic acid)
poly(AMImI)	Poly(1-(2-acryloyloxy-ethyl)-3-methyl-imidazol-1-ium iodide)
P3AT	Poly(3-alkylthiophene)
PBDT-DTBT	Polybenzo[2,1-b:3,4-b′]dithiophene-4,7-Di(thiophen-2-yl)benzothiadiazole
PCPDTBT	Poly[2,6-(4,4-bis-(2-ethylhexyl)-4H-cyclopenta-[2,1-b;3,4-b′]-dithiophene)-alt-4,7-(2,1,3-benzothiadiazole)]
P3CT	Poly(3-carboxydithiophene)
PFSDCN	Poly[2,7-(9,9-dioctylfluorene)-alt-2-((4-(diphenylamino)phenyl) thiophen-2-yl) malononitrile]
PDDC	Poly(9-dodecylcarbazole)
PDDCT	Poly[(9-dodecylcarbazole)-co-thiophene]

PEDOT:PSS	Poly(3,4-ethylenedioxythiophene) polystyrene sulfonate
PEG	Poly(ethylene glycol)
PEO	Poly(ethylene oxide)
PEODME	Poly(ethylene oxide dimethyl ether)
PCDTBT	Poly[N-9˝-hepta-decanyl-2,7-carbazole-alt-5,5-(4′,7′-di-2thienyl-2′,1′,3′-benzothiadiazole
P3HT	Poly(3-hexylthiophene)
MDMO-PPV	Poly[2-methoxy-5-(3′,7′-dimethyloctyloxy)-1,4-phenylenevinylene]
MEH-PPV	Poly[2-methoxy-5-(2-ethylhexyloxy)]-1,4-phenylenevinylene
POT	Poly(3-octylthiophene)
POEM	Poly(oxyethylene)-segmented amides and imides
PPV	Poly(p-phenylene vinylene)
PU	Polyurethane
PVK	Poly(9-vinylcarbazole)
PVDF-HFP	Poly(vinylidenefluoride-co-hexafluoropropylene)
PVP	Poly(4-vinylpyridine)
KBr	Potassium bromide
KI	Potassium iodide
PC	Propylene carbonate
RTIL	Room temperature ionic liquids
SEM	Scanning electron microscopy
SAED	Selected area electron diffraction
J_{sc}	Short circuit current density
SiO_2	Silica
Ag	Silver
AgBr	Silver bromide
AgCl	Silver chloride
$AgNO_3$	Silver nitrate

V_O^+	Singly ionized oxygen vacancy
Zn_i^+	Singly ionized zinc interstitial
SWCNT	Single walled carbon nanotube
$NaBH_4$	Sodium borohydride
NaCl	Sodium chloride
NaOH	Sodium hydroxide
NaI	Sodium iodide
NaSCN	Sodium thiocyanate
SPR	Surface plasmon resonance
TBP	Tertiary butyl pyridine
THF	Tetrahydrofuran
spiro-OMeTAD	2,2,7,7-Tetrakis-(N,N-di-p-methoxyphenylamine)-9,9-spirobifluorene
Pr4NI	Tetrapropylammonium iodide
TGA	Thermogravimetric analysis
TiO_2	Titanium dioxide
$TiCl_4$	Titanium tetrachloride
TEM	Transmission electron microscopy
SD2	Triphenylamine dye
UV	Ultraviolet
UV-visible	Ultraviolet-visible
NVK	9-Vinylcarbazole
VTF	Vogel-Tamman-Fulcher
XRD	X-ray diffractometer or X-ray diffraction
$Zn(CH_3COO)_2$	Zinc acetate
$Zn(OH)_2$	Zinc hydroxide
ZnO	Zinc oxide
$Zn\text{-}(CF_3SO_3)_2$	Zinc triflate

cm	Centimeter
R_{ct1}	Charge transfer resistance at the counter electrode/electrolyte interface
R_{ct2}	Charge transfer resistance at the electrolyte/TiO_2 electrode interface OR Charge recombination resistance at the photoanode
$\eta_{transport}$	Charge transport within the solid to the solid-liquid interface
°C	Degree centigrade
θ	Diffraction angle
E_g^{ec}	Electrochemical band gap
eV	Electronvolt
λ_{ex}	Excitation wavelength
FWHM	Full width at half-maxima
T_g	Glass transition temperature
g	Gram
h	Hour
IPCE	Incident photon conversion efficiency
$\eta_{interface}$	Interfacial charge transfer across the solid-liquid interface
δ	Ionic conductivity
keV	Kilo-electronvolt
kΩ	Kilo ohm
kW	Kilowatt
kV	Kilovolt
T_d	Major degradation temperature
P_{max}	Maximum power
J_{max}	Maximum value of photocurrent density
V_{max}	Maximum value of voltage
m	Meter
µL	Microlitre

mA	Milliampere
$mAcm^{-2}$	Milliampere per square centimeter
mg	Milligram
mL	Millilitre
mM	Millimolar
mV	Millivolt
mW	Milliwatt
min^{-1}	$Minute^{-1}$
M	Molar
nm	Nanometer
pH	Negative logarithm of hydrogen ion concentration
Ω-cm	Ohm-centimeter
Ω/sq	Ohm per square (sheet resistance with a uniform sheet thickness)
ϕ_{ox}	Onset oxidation potentials
ϕ_{red}	Onset reduction potentials
E_g^{op}	Optical band gap
Pa	Pascal
η	Photo conversion efficiency
J	Photocurrent density
P_{in}	Power of the incident light
rpm	Revolutions per minute
s	Second
R_s	Series resistance
I_{sc}	Short-circuit current
Scm^{-1}	Siemen per centimeter
K_{sp}	Solubility product
V	Volt or Voltage