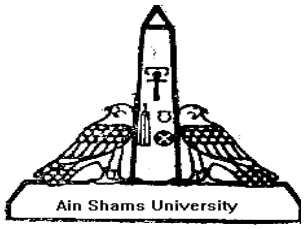

STUDIES ON CHEMICAL SOLAR CELLS: DESIGN, FABRICATION AND CHARACTERIZATION

Thesis Submitted
By

EMAN MOHAMED MOHAMED AHMED

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List of Abbreviations

β	The line width at half-maximum height.
$\mathbf{A_{app}}$	Apparent absorption.
$\mathbf{A_o}$	Absorbance at zero time.
$\mathbf{A_t}$	Absorbance at time t.
$\boldsymbol{\varepsilon_s}$	The dielectric constant of the semiconductor.
CB	Conduction band.
DSSCs	Dye-sensitized solar cells.
e	The electron charge.
$\mathbf{E_g}$	Band gap energy.
eV	Electron volt.
FF	Fill factor.
HOMO	Highest occupied molecule orbital.
hr	Hours.
$\mathbf{h\upsilon}$	Photons energy.
$\mathbf{I_{max}}$	Maximum current.
IPCE	The incident monochromatic photon-to-current conversion efficiency.
$\mathbf{I_{sc}}$	Short circuit current.
$\mathbf{J_{sc}}$	Short circuit current density.
k	Rate constant.
L	The crystallite site.

LUMO	Lowest unoccupied molecule orbital.
mA	Milliampere
min	Minutes.
MLCT	Metal to ligand charge transfer.
mM	Millimolar.
MPP	Maximum power point.
M_{wt}	Molecular weight.
N3 dye	cis-dithiocyanato bis(4,4′-dicarboxy-2,2′-bipyridine) ruthenium (II) ($Ru(dcbpyH_2)_2$ $(NSC)_2$,$(Bu_4N)_2$ $[Ru(dcbpyH_2)_2 (NSC)_2]$.
N719	cis-bis(isothiocyanato)bis(2,2′bipyridy1-4,4′dicarboxylato) ruthenium (II) bis-tetrabutyl ammonium $(Bu_4N)_4$ $[Ru(dcbpy)_2 (NSC)_2]$.
nm	Nanometer.
PEG	Poly ethylene glycol.
pH	Negative logarithm of hydrogen ions concentration.
P_{max}	Maximum power output.
PV	Photovoltaic.
R	Reflectance.
R_∞	Absolute remittance.
RE	Renewable energy.
RR-133	Remazole red RB-133
SAED	Selected area electron diffraction pattern.

SEM	Scanning electron microscope.
TCO	Transparent conducting oxide.
TEM	Transmission electron microscope.
UV	Ultraviolet radiation.
V	Volt.
VB	Valence band.
Vis	Visible light.
$\mathbf{V_{max}}$	Maximum voltage.
$\mathbf{V_{oc}}$	Open Circuit Voltage.
W	Watt.
XRD	X-ray diffraction.
η	Efficiency of the solar cell.
λ	Wavelength.
$\mathbf{\nu^*}$	Wave number.

List of Tables

List of Figures

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Aim of the Work

The performance of dye sensitized solar cells (DSSCs) is mainly based on the dye as a sensitizer. The stability, as well as the absorption spectrum of the dye sensitizers and the anchorage of the dye to the surface of TiO_2 is important parameters determining the efficiency of the cell. Generally, transition metal coordination compounds (ruthenium polypyridyl complexes) are used as the effective sensitizers, due to their intense charge-transfer absorption in the whole visible range and highly efficient metal-to-ligand charge transfer. However, ruthenium polypyridyl complexes contain a heavy metal, which is undesirable from point of view of the environmental aspects. Moreover, the process to synthesize the complexes is complicated and costly. Alternatively, natural dyes can be used for the same purpose with an acceptable efficiency. The advantages of natural dyes include their availability and low cost.

Natural dyes have become available alternative to expensive and rare organic sensitizers because of its low cost, easy attainability, abundance in supply of raw materials and no environmental threat. The nature as well as the molecular structure of these dyes strongly affects performance of the dye-sensitized solar cells.