

Read Online The
Physics Of Solar
Cells Properties
Of Semiconductor
Materials

The Physics Of Solar Cells Properties Of Semiconduct or Materials

*This second
edition of
Concentrating
Solar Power
Technology*

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Read Online The
Physics Of Solar
Cells Properties

*edited by Keith
Lovegrove and
Wes Stein*

*presents a fully
updated
comprehensive
review of the
latest
technologies and
knowledge, from
the fundamental
science to*

Read Online The
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***systems design,
development, and
applications. Part
one introduces
the fundamental
principles of CSP
systems,
including site
selection and
feasibility
analysis,
alongside socio-***

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**economic and
environmental
assessments.**

***Part two focuses
on technologies
including linear
Fresnel reflector
technology,
parabolic-trough,
central tower,
and parabolic
dish CSP***

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***systems, and
concentrating
photovoltaic
systems. Thermal
energy storage,
hybridization with
fossil fuel power
plants, and the
long-term market
potential of CSP
technology are
also explored.***

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Part three goes on to discuss optimization, improvements, and applications, such as absorber materials for solar thermal receivers, design optimization through integrated techno-

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***economic
modelling, and
heliostat size
optimization.***

***With its
distinguished
editors and
international
team of expert
contributors,
Concentrating
Solar Power***

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***Technology, 2nd
Edition is an
essential guide
for all those
involved or
interested in the
design,
production,
development,
optimization, and
application of
CSP technology,***

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Cells Properties
including
renewable energy
engineers and
consultants,
environmental
governmental
departments,
solar thermal
equipment
manufacturers,
researchers, and
academics.

Read Online The
Physics Of Solar
Cells Properties

***Provides a
comprehensive
review of***

***concentrating
solar power
(CSP)***

***technology, from
the fundamental
science to
systems design,
development and
applications***

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Physics Of Solar
Cells Properties
Of Semiconductor
Materials

Reviews
fundamental
principles of CSP
systems,
including site
selection and
feasibility
analysis and
socio-economic
and
environmental
assessments

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Physics Of Solar
Cells Properties

*Includes an
overview of the
key technologies
of parabolic-*

*trough, central
tower linear*

*Fresnel reflector,
and parabolic
dish CSP*

*systems, and
concentrating
photovoltaic*

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systems

This book

presents a

comprehensive

overview of the

fundamental

concept, design,

working

protocols, and

diverse photo-

chemicals

aspects of

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different solar cell systems with promising prospects, using computational and experimental techniques. It presents and demonstrates the art of designing and developing various solar cell

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**systems through
practical
examples.**

**Compared to
most existing
books in the
market, which
usually analyze
existing solar cell
approaches this
volume provides
a more**

Read Online The
Physics Of Solar
Cells Properties

***comprehensive
view on the field.***

***Thus, it offers an
in-depth***

***discussion of the
basic concepts of
solar cell design
and their***

***development,
leading to higher
power***

conversion

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efficiencies. The book will appeal to readers who are interested in both fundamental and application-oriented research while it will also be an excellent tool for graduates, researchers, and

Read Online The
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Cells Properties
*professionals
working in the
field of*

*photovoltaics
and solar cell
systems.*

*This book
contains
chapters in which
the problems of
modern
photovoltaics are*

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Cells Properties
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considered. The majority of the chapters provide an overview of the results of research and development of different types of solar cells. Such chapters are completed by a justification for a

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Cells Properties

*new solar cell
structure and
technology. Of
course, highly
effective solar
energy*

*conversion is
impossible
without an in-
depth*

*examination of
the solar cell*

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***components as
physical
materials. The
relations between
structural,
thermodynamic,
and optical
properties of the
physical material
without
addressing the
band theory of***

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Cells, Properties

***solids are of both
theoretical and
practical interest.***

***Requirements
formulated for
the material are
also to be used
for maximally
efficient
conversion of
solar radiation
into useful work.***

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Cells Properties

***Unparalleled
coverage of the
most vibrant***

***research field in
photovoltaics!***

Hybrid

perovskites,

revolutionary

game-changing

semiconductor

materials, have

every favorable

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***optoelectronic
characteristic
necessary for
realizing high
efficiency solar
cells. The
remarkable
features of hybrid
perovskite
photovoltaics,
such as superior
material***

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Cells Properties

***properties, easy
material
fabrication by
solution-based
processing, large-
area device
fabrication by an
inkjet technology,
and simple solar
cell structures,
have brought
enormous***

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Cells Properties

***attentions,
leading to a rapid
development of
the solar cell
technology at a
pace never
before seen in
solar cell history.***

***Hybrid Perovskite
Solar Cells:
Characteristics
and Operation***

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***covers extensive
topics of hybrid
perovskite solar
cells, providing
easy-to-read
descriptions for
the fundamental
characteristics of
unique hybrid
perovskite
materials (Part I)
as well as the***

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Cells Properties

***principles and
applications of
hybrid perovskite
solar cells (Part
II). Both basic
and advanced
concepts of
hybrid perovskite
devices are
treated
thoroughly in this
book; in***

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Cells. Properties
Of Semiconductor
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***particular,
explanatory
descriptions for
general physical
and chemical
aspects of hybrid
perovskite
photovoltaics are
included to
provide
fundamental
understanding.***

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This comprehensive book is highly suitable for graduate school students and researchers who are not familiar with hybrid perovskite materials and devices, allowing

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*the accumulation
of the accurate
knowledge from
the basic to the
advanced levels.*

*Physics and
Technology of A
morphous-
Crystalline
Heterostructure
Silicon Solar
Cells*

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Cells Properties
Of Semiconductor
Materials

**Organic and
Hybrid Solar
Cells**

**Handbook of the
Physics of Thin-
Film Solar Cells
Physics,
Technologies,
and Thin Film
Devices
Theory,
Experiment, and**

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Cells Properties
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Materials

Device

Simulation

***The Physics of
Solar Energy
Conversion***

PHYSICS OF Solar
Energy Science/Phys
ics/Energy The
definitive guide to
the science of solar
energy You hold in
your hands the first,

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and only, truly
comprehensive
guide to the most
abundant and most
promising source of
alternative
energy—solar power.
In recent years, all
major countries in
the world have been
calling for an energy
revolution. The

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renewable energy
Of Semiconductor
industry will drive a
Materials
vigorous expansion

of the global
economy and create
more “green” jobs.

The use of fossil
fuels to power our
way of living is
moving toward an
inevitable end, with
sources of coal,

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Of Semiconductor
Materials
petroleum, and
natural gas being
fiercely depleted.

Solar energy offers a
ubiquitous,
inexhaustible, clean,
and highly efficient
way of meeting the
energy needs of the
twenty-first century.
This book is
designed to give the

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reader a solid footing in the general and basic physics of solar energy, which will be the basis of research and development in new solar engineering technologies in the years to come. As solar technologies

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like solar cells, solar
thermal power

generators, solar

water heaters, solar

photochemistry

applications, and

solar space heating-

cooling systems

become more and

more prominent, it

has become essential

that the next

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Cells Properties

generation of energy
experts—both in
academia and

industry—have a one-
stop resource for
learning the basics
behind the science,
applications, and
technologies
afforded by solar
energy. This book
fills that need by

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Cells Properties
Of Semiconductor
Materials

laying the
groundwork for the
projected rapid

expansion of future
solar projects.

Nanostructured
Materials for Solar
Energy Conversion
covers a wide
variety of materials
and device types
from inorganic

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materials to organic
materials. This book
deals with basic

semiconductor
physics, modelling
of nanostructured
solar cell,

nanostructure of
conventional solar
cells such as silicon,
CIS and CdTe, dye-
sensitized solar cell,

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organic solar cell,
photosynthetic
materials, fullerene,
extremely thin
absorber (ETA) solar
cell, quantum
structured solar cell,
intermediate band
solar cell, carbon
nanotube, etc.
including basic
principle and the

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latest results. There
are many books
written on

conventional p-n
junction solar cells,
but few books focus
on new concepts in
this area. * Focuses
on the use of
nanostructured
materials for solar
energy * Looks at a

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wide variety of
materials and device
types * Covers both

organic and

inorganic materials

This introduction to
the physics of silicon
solar cells focuses
on thin cells, while
reviewing and
discussing the
current status of the

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important
technology. An
analysis of the
spectral quantum
efficiency of thin
solar cells is given as
well as a full set of
analytical models.
This is the first
comprehensive
treatment of light
trapping techniques

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Materials

for the enhancement
of the optical
absorption in thin
silicon films.

The book provides
an explanation of the
operation of
photovoltaic devices
from a broad
perspective that
embraces a variety
of materials

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concepts, from nanostructured and highly disordered organic materials, to highly efficient devices such as the lead halide perovskite solar cells. The book establishes from the beginning a simple but very rich model

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of a solar cell, in order to develop and understand step by step the photovoltaic operation according to fundamental physical properties and constraints. It emphasizes the aspects pertaining to the functioning of a solar cell and the

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Materials

determination of
limiting efficiencies
of energy

conversion. The
final chapters of the
book establish a
more refined and
realistic treatment of
the many factors that
determine the actual
performance of
experimental

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Cells Properties

devices: transport
gradients, interfacial
recombination,

optical losses and so
forth. The book

finishes with a short
review of additional
important aspects of
solar energy

conversion, such as
the photonic aspects
of spectral

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Materials

modification, and
the direct conversion
of solar photons to
chemical fuel via
electrochemical
reactions.

Next Generation
Photovoltaics and Its
Applications
Principles,
Developments, and
Applications

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Cells Properties
Handbook of
Of Semiconductor
Photovoltaic Science
Materials
and Engineering
Organic Solar Cells

Nanostructured
Materials for Solar
Energy Conversion
The most
comprehensive,
authoritative
and widely

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Materials

cited

reference on

photovoltaic

solar energy

Fully revised

and updated,

the Handbook

of

Photovoltaic

Science and

Engineering,

Second Edition

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incorporates
the
substantial
technological
advances and
research
developments
in
photovoltaics
since its
previous
release. All

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topics
relating to
the
photovoltaic
(PV) industry
are discussed
with
contributions
by
distinguished
international
experts in the

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Cells Properties
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field.

Significant
new coverage
includes:

three
completely new
chapters and
six chapters
with new
authors device
structures,
processing,

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Cells Properties
and
Of Semiconductor
Manufacturing
Materials

options for
the three
major thin
film PV
technologies
high
performance
approaches for
multijunction,
concentrator,

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and space
Of Semiconductor
applications
Materials

new types of
organic
polymer and
dye-sensitized
solar cells
economic
analysis of
various policy
options to
stimulate PV

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growth
including
effect of
public and
private
investment
Detailed
treatment
covers:
scientific
basis of the
photovoltaic

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Materials
effect and
solar cell
operation the
production of
solar silicon
and of silicon-
based solar
cells and
modules how
choice of
semiconductor
materials and

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their
production
influence
costs and
performance
making
measurements
on solar cells
and modules
and how to
relate results
under

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standardised
test
conditions to
real outdoor
performance
photovoltaic
system
installation
and operation
of components
such as
inverters and

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batteries.

architectural

applications

of building-

integrated PV

Each chapter

is structured

to be

partially

accessible to

beginners

while

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providing
detailed
information of
the physics
and technology
for experts.

Encompassing a
review of past
work and the
fundamentals
in solar
electric

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science, this is a leading reference and invaluable resource for all practitioners, consultants, researchers and students in the PV industry.

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Based on the
highly
regarded and
extremely
successful
first edition,
this
thoroughly
revised,
updated and
expanded
edition

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contains the latest knowledge on the mechanisms of solar energy conversion.

The textbook describes in detail all aspects of solar cell

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function, the physics behind every single step, as well as all the issues to be considered when improving solar cells and their efficiency. Requiring no

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more than
standard
physics
knowledge, the
book enables
both students
and
researchers to
understand the
factors
driving
conversion

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efficiency and to apply this knowledge to their own solar cell development. New exercises after each chapter help students to consolidate their freshly

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acquired
knowledge,
while the book
also serves as
a reference
for
researchers
already
working in
this exciting
and
challenging

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field.

With the increasing world-energy demand there is a growing necessity for clean and renewable energy. The sun being one of the most

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abundant
potential
sources

accounts for
less than 1%
of the global
energy supply.

The market for
solar cells is
one of the
most strongly
increasing

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markets, even though the prize of

conventional solar cells is still quite high. New emerging technologies, such as organic and hybrid solar

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cells have the potential to decrease the price of solar energy drastically.

This book offers an introduction to these new types of solar cells and

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discusses
fabrication,
different
architectures
and their
device physics
on the bases
of the
author's
teaching
course on a
master degree

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level. A
comparison
with
conventional
solar cells
will be given
and the
specialties of
organic solar
cells
emphasized.
Today's solar

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cell multi-GW
market is
dominated by
crystalline
silicon (c-Si)
wafer
technology,
however new
cell concepts
are entering
the market.
One very

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promising
solar cell
design to
answer these
needs is the
silicon hetero-
junction solar
cell, of which
the emitter
and back
surface field
are basically

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produced by a
low

temperature

growth of

ultra-thin

layers of

amorphous

silicon. In

this design,

amorphous

silicon (a-

Si:H)

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constitutes
both „emitter“
and „base-
contact/back
surface field“
on both sides
of a thin
crystalline
silicon wafer-
base (c-Si)
where the
electrons and

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holes are photogenerated; at the same time, a-Si:H

passivates the c-Si surface.

Recently, cell efficiencies above 23% have been

demonstrated for such solar

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cells. In this
book, the
editors
present an
overview of
the state-of-
the-art in
physics and
technology of
amorphous-
crystalline he
terostructure

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silicon solar
cells. The
heterojunction
concept is
introduced,
processes and
resulting
properties of
the materials
used in the
cell and their
heterointerfac

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es are
discussed and
characterizati
on techniques
and simulation
tools are
presented.

New Approaches
and Reviews
Perovskites,
Organics, and
Photovoltaic

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Cells Properties
Fundamentals
Of Semiconductor
Principles of
Materials
Solar Cells,
LEDs and
Diodes
Redefining the
Limits of
Solar Power
Conversion
Efficiency
Advanced Solar
Energy

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Materials

Conversion

Solar Cells

and Their

Applications

A textbook

introducing the

physical concepts

required for

acomprehensive

understanding of p-

n junction devices,

light emitting diodes

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and solar cells.
Semiconductor
devices have made a
major impact on the
way we work and
live. Today
semiconductor p-n
junction diode
devices are
experiencing
substantial
growth: solar cells
are used on an

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unprecedented
scale in the
Materials

renewable energy
industry; and light
emitting
diodes(LEDs) are
revolutionizing
energy efficient
lighting. These
twoemerging
industries based on
p-n junctions make
a significant contrib

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ution to the
reduction in fossil
fuel consumption.
Principles of Solar
Cells, LEDs and
Diodes covers the
twomost important
applications of
semiconductor
diodes - solar cells
and LEDs - together
with quantitative
coverageof the

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physics of the p-n junction. The reader will gain a thorough understanding of p-n junctions as the text begins with semiconductor and junction device fundamentals and extends to the practical implementation of semiconductors

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in both photovoltaic and LED devices. The treatment of a range of important semiconductor materials and device structures is also presented in a readable manner.

Topics are divided into the following six chapters; •

Semiconductor

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Physics • The PN
Junction Diode •
Photon Emission
and Absorption •
The Solar Cell •
Light Emitting
Diodes • Organic
Semiconductors,
OLEDs and Solar
Cells Containing
student problems at
the end of each
chapter and worked

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example problems
throughout, this
textbook is intended
for senior level
undergraduate
students doing
courses in electrical
engineering, physics
and materials
science.

Researchers
working on solar
cells and LED

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devices, and those in the electronics industry would also benefit from the background information the book provides.

The Physics of Solar Cells
World Scientific Publishing
Company

This book provides a comprehensive

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introduction to the physics of the photovoltaic cell. It is suitable for undergraduates, graduate students, and researchers new to the field. It covers: basic physics of semiconductors in photovoltaic devices; physical

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models of solar cell operation; characteristics and design of common types of solar cell; and approaches to increasing solar cell efficiency. The text explains the terms and concepts of solar cell device physics and shows the reader how to

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formulate and solve relevant physical problems. Exercises and worked solutions are included.

Photovoltaics, the direct conversion of sunlight to electricity, is now the fastest growing technology for electricity

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generation. Present
"first generation"

products use the
same silicon wafers
as in

microelectronics.

"Second generation"

thin-films, now

entering the market,

have the potential

to greatly improve

the economics by

eliminating material

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costs. Martin Green,
one of the world ' s
foremost

photovoltaic
researchers, argues
in this book that
"second generation"
photovoltaics will
eventually reach its
own material cost
constraints,
engendering a
"third generation" of

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Of Semiconductor
Materials
high performance
thin-films. The book
explores, self-
consistently, the
energy conversion
potential of
advanced
approaches for
improving
photovoltaic
performance and
outlines possible
implementation

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paths.
Of Semiconductor
Solar Cells
Materials
Concentrating Solar
Power Technology
Hybrid Perovskite
Solar Cells
Characteristics and
Operation
Thin-Film
Crystalline Silicon
Solar Cells
Solar Energy
Discover a one-of-a-kind

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treatment of perovskite
photovoltaics In less than
a decade, the

photovoltaics of organic-
inorganic halide

perovskite materials have
surpassed the efficiency
of semiconductor

compounds like CdTe
and CIGS in solar cells.

In Perovskite

Photovoltaics and

Optoelectronics: From

Fundamentals to

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Advanced Applications,
distinguished engineer

Dr. Tsutomu Miyasaka
delivers a comprehensive
exploration of
foundational and
advanced topics
regarding halide
perovskites. It
summarizes the latest
information and
discussion in the field,
from fundamental theory
and materials to critical

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Materials

device applications. With contributions by top scientists working in the perovskite community, the accomplished editor has compiled a resource of central importance for researchers working on perovskite related materials and devices.

This edited volume includes coverage of new materials and their commercial and market

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potential in areas like
perovskite solar cells and
perovskite LEDs. It also
includes: A thorough
introduction to halide
perovskite materials, their
synthesis, and dimension
control Comprehensive
explorations of the
photovoltaics of halide
perovskites and their
historical background
Practical discussions of
solid-state and transfer

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mechanisms in halide
perovskite
Of Semiconductor

Materials
semiconductors In-depth

examinations of multi-
cation anion-based high

efficiency perovskite

solar cells Perfect for

materials scientists,

surface physicists, surface

chemists, and solid-state

physicists, Perovskite

Photovoltaics and

Optoelectronics: From

Fundamentals to

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Advanced Applications is also an indispensable resource for solid state chemists and electrical engineers.

Solar cells are semiconductor devices that convert light photons into electricity in photovoltaic energy conversion and can help to overcome the global energy crisis. Solar cells have many applications

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including remote area power systems, earth-orbiting satellites, wristwatches, water pumping, photodetectors and remote radiotelephones. Solar cell technology is economically feasible for commercial-scale power generation. While commercial solar cells exhibit good performance and

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Materials

stability, still researchers are looking at many ways to improve the performance and cost of solar cells via modulating the fundamental properties of semiconductors. Solar cell technology is the key to a clean energy future. Solar cells directly harvest energy from the sun ' s light radiation into electricity are in an ever-

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growing demand for
future global energy
production. Solar cell-
based energy harvesting
has attracted worldwide
attention for their notable
features, such as cheap
renewable technology,
scalable, lightweight,
flexibility, versatility, no
greenhouse gas emission,
environment, and
economy friendly and
operational costs are

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quite low compared to other forms of power generation. Thus, solar cell technology is at the forefront of renewable energy technologies which are used in telecommunications, power plants, small devices to satellites.

Aiming at large-scale implementation can be manipulated by various types used in solar cell

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design and exploration of
new materials towards
improving performance
and reducing cost.

Therefore, in-depth
knowledge about solar
cell design is fundamental
for those who wish to
apply this knowledge and
understanding in
industries and academics.
This book provides a
comprehensive overview
on solar cells and

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explores the history to evolution and present scenarios of solar cell design, classification, properties, various semiconductor materials, thin films, wafer-scale, transparent solar cells, and so on. It also includes solar cells ' characterization analytical tools, theoretical modeling, practices to enhance

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conversion efficiencies,
applications and patents.

Beginning with an
overview and historical
background of Copper
Zinc Tin Sulphide
(CZTS) technology,
subsequent chapters
cover properties of CZTS
thin films, different
preparation methods of
CZTS thin films, a
comparative study of
CZTS and CIGS solar

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cell, computational
approach, and future
applications of CZTS

thin film solar modules to
both ground – mount
and rooftop installation.

The semiconducting
compound (CZTS) is
made up

earth – abundant,
low – cost and

non – toxic elements,
which make it an ideal
candidate to replace

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Cu(In,Ga)Se₂ (CIGS)
and CdTe solar cells

which face material
scarcity and toxicity
issues. The device
performance of
CZTS – based thin film
solar cells has been
steadily improving over
the past 20 years, and
they have now reached
near commercial
efficiency levels (10%).
These achievements

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Materials
prove that CZTS – based
solar cells have the

potential to be used for
large – scale deployment
of photovoltaics. With
contributions from
leading researchers from
academia and industry,
many of these authors
have contributed to the
improvement of its
efficiency, and have rich
experience in preparing a
variety of

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semiconducting thin
films for solar cells.

This handbook is a
compendium giving a
comprehensive
description of the basics
of semiconductor physics
relevant to the design and
analysis of thin film solar
cell materials. It starts
from the basics of
material science,
describing the material
and its growth, defect

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and electrical properties,
the basics of its

interaction with photons
and the involved

statistics, proceeding to

space charge effects in

semiconductors and pn-

junctions. Most attention

is given to analyze homo-

and hetero-junction solar

cells using various

models and applying the

field-of-direction analysis

for discussing current

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voltage characteristics,
and helping to discover
the involvement of high-
field effects in solar cells.

The comprehensive
coverage of the main
topics of - and relating to
- solar cells with extensive
reference to literature
helps scientists and
engineers at all levels to
reach a better
understanding and
improvement of solar cell

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properties and their
production. The author
is one of the founders of
thin film solar cell
research.

Chalcogenide

Photovoltaics

From Principles to New
Concepts

Physics of Solar Energy

Unconventional Thin
Film Photovoltaics

Solar Cells and Energy
Materials

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Materials Concepts for
Solar Cells
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Materials
A modern
challenge is for
solar cell materials
to enable the
highest solar
energy conversion
efficiencies, at
costs as low as
possible, and at an
energy balance as

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sustainable as
necessary in the
future. This

textbook explains
the principles,
concepts and
materials used in
solar cells. It
combines basic
knowledge about
solar cells and the
demanded criteria

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Materials
for the materials
with a
comprehensive
introduction into
each of the four
classes of
materials for solar
cells, i.e. solar cells
based on
crystalline silicon,
epitaxial layer
systems of III-V

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Materials
semiconductors,
thin-film
absorbers on
foreign substrates,
and nano-
composite
absorbers. In this
sense, it bridges a
gap between
basic literature on
the physics of
solar cells and

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books specialized
Of Semiconductor
Materials
on certain types of
solar cells. The last
five years had
several
breakthroughs in
photovoltaics and
in the research on
solar cells and
solar cell
materials. We
consider them in

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Cells Properties
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this second
edition. For
example, the high
potential of
crystalline silicon
with charge-
selective hetero-
junctions and
alkaline
treatments of thin-
film absorbers,
based on

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chalcopyrite, enabled new records. Research activities were boosted by the class of hybrid organic-inorganic metal halide perovskites, a promising newcomer in the field. This is

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essential reading
for students
Of Semiconductor
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interested in solar
cells and materials
for solar cells. It
encourages
students to solve
tasks at the end of
each chapter. It
has been well
applied for
postgraduate

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students with
background in
materials science,
engineering,
chemistry or
physics.

The first
comprehensive
book on thin-film
solar cells,
potentially a key
technology for

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solving the energy
production

problem in the

21st century in an

environmentally

friendly way. It

covers a wide

range of scientific

and technological

aspects of thin

film

semiconductors -

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Cells Properties
deposition
technologies,
growth

mechanisms and
the basic
properties of
amorphous and
nano-crystalline
silicon - as well as
the optimum
design theory and
device physics of

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high-efficiency solar cells, especially of single-junction and multi-junction solar cells. The development of large-area solar cell modules using single and multi-junction solar cells is also considered.

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Examples of recent photovoltaic systems are presented and analysed.

Solar Cells and Energy Materials takes an in-depth look at the basics behind energy, solar energy as

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well as future and
alternative energy
materials. The

author presents
insights into the
current state-of-
the-art of solar
cells, including
their basic science,
inorganic, organic
and Perovskite-
type cells. The

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author also gives
an outlook into
next generation
energy materials
and sources. The
focus of this book
is not only the
presentation of
available and
developing
energy materials,
but their thorough

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examination and
characterization.

In addition to
solar cell
technology and
the promising
application of
nanostructures
like quantum dots,
the author
discusses the
science and

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potential of
nuclear fusion
materials and
other energy
materials like
hydrogen storage
materials, BN
nanomaterials,
alternative fuel
cells and SIC FET.
Peter Würfel
describes in detail

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all aspects of solar cell function, the physics behind every single step, as well as all the issues to be considered when improving solar cells and their efficiency. Based on the highly successful German

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version, but
thoroughly
revised and
updated, this
edition contains
the latest
knowledge on the
mechanisms of
solar energy
conversion.
Requiring no more
than standard

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physics
knowledge, it
enables readers to
understand the
factors driving
conversion
efficiency and to
apply this
knowledge to
their own solar
cell development.
Solar Cell Device

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Thin-Film Solar
Materials
Cells

Emerging
Strategies to
Reduce
Transmission and
Thermalization
Losses in Solar
Cells
Operating
Principles,

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Technology and
System
Of Semiconductor
Materials
Applications

The Physics of
Solar Cells
Perovskite

Photovoltaics and
Optoelectronics

*This book covers in a
textbook-like fashion
the basics of organic
solar cells, addressing*

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Cells Properties
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Materials

*the limits of
photovoltaic energy
conversion and giving
a well-illustrated
introduction to
molecular electronics
with focus on the
working principle and
characterization of
organic solar cells.
Further chapters
based on the author's
dissertation focus on*

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Materials

*the electrical
processes in organic
solar cells by
presenting a detailed
drift-diffusion
approach to describe
exciton separation
and charge-carrier
transport and
extraction. The
results, although
elaborated on small-
molecule solar cells*

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*and with focus on the
zinc phthalocyanine:*

*C60 material system,
are of general nature.*

*They propose and
demonstrate*

experimental

approaches for

getting a deeper

understanding of the

dominating processes

in amorphous thin-

film based solar cells

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in general. The main focus is on the interpretation of the current-voltage characteristics (J-V curve). This very standard measurement technique for a solar cell reflects the electrical processes in the device. Comparing experimental to

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simulation data, the author discusses the reasons for S-Shaped J-V curves, the role of charge carrier mobilities and energy barriers at interfaces, the dominating recombination mechanisms, the charge carrier generation profile, and other efficiency-

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Cells Properties

*limiting processes in
organic solar cells.*

*The book concludes
with an illustrative
guideline on how to
identify reasons for
changes in the J-V
curve. This book is a
suitable introduction
for students in
engineering, physics,
material science, and
chemistry starting in*

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*of the field of organic
or hybrid thin-film
photovoltaics. It is just
as valuable for
professionals and
experimentalists who
analyze solar cell
devices.*

*Solar Cell Device
Physics offers a
balanced, in-depth
qualitative and
quantitative treatment*

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Cells Properties
*of the physical
principles and
operating*

*characteristics of
solar cell devices.*

*Topics covered
include photovoltaic
energy conversion and
solar cell materials
and structures, along
with homojunction
solar cells. Semicondu*

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Cells Properties

*heterojunction cells
and surface-barrier
solar cells are also*

*discussed. This book
consists of six*

chapters and begins

by introducing the

reader to the basic

physical principles

and materials

properties that are the

foundations of

photovoltaic energy

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*conversion, with
emphasis on various
photovoltaic devices
capable of efficiently
converting solar
energy into usable
electrical energy. The
electronic and optical
properties of
crystalline,
polycrystalline, and
amorphous materials
with both organic and*

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*Of Semiconductor
Materials*
*inorganic materials
are considered,
together with the
manner in which
these properties
change from one
material class to
another and the
implications of such
changes for
photovoltaics.*

*Generation,
recombination, and*

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Cells Properties

*bulk transport are
also discussed. The
two mechanisms of*

photocarrier

collection in solar

cells, drift and

diffusion, are then

compared. The

remaining chapters

focus on specific

solar cell device

classes defined in

terms of the interface

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Cells Properties

*structure employed:
homojunctions, semiconductor-*

semiconductor

*heterojunctions, and
surface-barrier*

devices. This

monograph is

*appropriate for use as
a textbook for*

*graduate students in
engineering and the*

sciences and for

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*seniors in electrical
engineering and
applied physics, as
well as a reference
book for those
actively involved in
solar cell research
and development.*

*This comprehensive
textbook takes you
through everything
you need to know
about solar energy*

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from the physics of photovoltaic (PV) cells through to the design of PV systems for real-life applications. Solar Energy is an invaluable reference for researchers, industrial engineers and designers working in solar energy generation. The book

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*is also ideal for
university and third-
level physics or
engineering courses
on solar photovoltaics,
with exercises to
check students'
understanding and
reinforce learning. It
is the perfect
companion to the
Massive Open Online
Course (MOOC) on*

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*Solar Energy (DelftX,
ET.3034TU)*

*presented by co-
author Arno Smets.*

*The course is
available in English
on the nonprofit open
source edX.org
platform, and in
Arabic on edraak.org.
Over 100,000 students
have already
registered for these*

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MOOCs.

*A major update of
solar cell technology
and the solar
marketplace Since the
first publication of
this important volume
over a decade ago,
dramatic changes
have taken place with
the solar market
growing almost
100-fold and the U.S.*

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moving from first to fourth place in the world market as analyzed in this Second Edition. Three bold new opportunities are identified for any countries wanting to improve market position. The first is combining pin solar cells with 3X concentration to

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*achieve economic
competitiveness near
term. The second is*

*charging battery-
powered cars with
solar cell-generated
electricity from
arrays in surrounding
areas—including the
car owners'*

*homes—while
simultaneously
reducing their home*

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Cells Properties

*electricity bills by over
ninety percent. The
third is formation of
economic "unions" of
sufficient combined
economic size to be
major competitors. In
this updated edition,
feed-in tariffs are
identified as the most
effective approach
for public policy.*

Reasons are provided

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*to explain why pin
solar cells outperform
more traditional pn
solar cells. Field test
data are reported for
nineteen percent pin
solar cells and for
~500X concentrating
systems with bare cell
efficiencies
approaching forty
percent. Paths to bare
cell efficiencies over*

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fifty percent are described, and key missing program elements are identified. Since government support is needed for new technology prototype integration and qualification testing before manufacturing scale up, the key economic

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measure is identified in this volume as the electricity cost in cents per kilowatt-hour at the complete installed system level, rather than just the up-front solar cell modules' costs in dollars per watt. This Second Edition will benefit technologists in the fields of solar cells

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*and systems; solar cell
researchers; power
systems designers;
academics studying
microelectronics,
semiconductors, and
solar cells; business
students and investors
with a technical
focus; and
government and
political officials
developing public*

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policy.

*Crystalline Silicon
Solar Cells*

Copper Zinc Tin

*Sulfide-Based Thin
Film Solar Cells*

*From Basic Principles
to Advanced Concepts
Third Generation*

Photovoltaics

An Introduction

*Defects In Functional
Materials*

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This book
contains
detailed

information on
the types,
structure,
fabrication, and
characterization
of organic solar
cells (OSCs). It
discusses
processes to

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Cells Properties
Of Semiconductor
Materials

improve efficiencies and the prevention of degradation in OSCs. It compares the cost-effectiveness of OSCs to those based on crystalline silicon and discusses ways

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Cells Properties
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Materials
to make OSCs
more
economical.

This book
provides a
practical guide
for the
fabrication,
processing, and
characterization
of OSCs and
paves the way

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for further
development in
OSC technology.

The research of
functional
materials has
attracted
extensive
attention in
recent years,
and its
advancement

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Cells Properties

nitrifies the
developments of
modern

sciences and
technologies
like green
sciences and
energy,

aerospace,
medical and
health, telecom
munications,

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Cells Properties
Of Semiconductor
Materials
and information
technology. The
present book

aims to

summarize the
research
activities

carried out in
recent years

devoting to the
understanding
of the physics

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and chemistry
Of Semiconductor
of how the
Materials

defects play a
role in the
electrical,
optical and
magnetic
properties and
the applications
of the different
functional
materials in the

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Materials
fields of
magnetism,
optoelectronic,
and photovoltaic
etc.

Research on
advanced
energy
conversion
devices such as
solar cells has
intensified in

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the last two
decades. A
broad landscape
of candidate
materials and
devices were
discovered and
systematically
studied for
effective solar
energy
conversion and

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Of Semiconductor
Materials.
utilization. New
concepts have
emerged

forming a rather
powerful picture
embracing the
mechanisms and
limitation to
efficiencies of
different types
of devices. The
Physics of Solar

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Materials

Energy
Conversion
introduces the
main physico-
chemical
principles that
govern the
operation of
energy devices
for energy
conversion and
storage, with a

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Cells Properties
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Materials
detailed view of
the principles of
solar energy

conversion

using advanced
materials. Key

Features

include:

Highlights

recent rapid

advances with

the discovery of

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Cells Properties
Of Semiconductor
Materials
perovskite solar
cells and their
development.

Analyzes the
properties of
organic solar
cells, lithium ion
batteries, light
emitting diodes
and the
semiconductor
materials for

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Materials
hydrogen
production by
water splitting.

Embraces
concepts from
nanostructured
and highly
disordered
materials to
lead halide
perovskite solar
cells Takes a

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broad
perspective and
comprehensivel
y addresses the
fundamentals so
that the reader
can apply these
and assess
future
developments
and
technologies in

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the field.

Introduces basic
techniques and
methods for
understanding
the materials
and interfaces
that compose
operative
energy devices
such as solar
cells and solar

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fuel converters.
The new edition
of this highly
regarded
textbook
provides a
detailed
overview of the
most important
characterization
techniques for
solar cells and a

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discussion of
their
advantages and
disadvantages.
It describes in
detail all
aspects of solar
cell function,
the physics
behind every
single step, as
well as all the

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issues to be considered when improving solar cells and their efficiency. The text is now complete with examples of how the appropriate characterization techniques enable the

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distinction
between several
potential

limitation

factors,

describing how

quantities that

have been

introduced

theoretically in

earlier chapters

become

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experimentally
accessible. With
exercises after
each chapter to
reinforce the
newly acquired
knowledge and
requiring no
more than
standard
physics
knowledge, this

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book enables
students and
professionals to
understand the
factors driving
conversion
efficiency and to
apply this to
their own solar
cell
development.

Physics of Solar

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Cells Properties
Of Semiconductor
Materials

Cells
Theory and
Experiment
Physics and
Technology
Development of
Solar Cells
Device Physics,
Processing,
Degradation,
and Prevention
The Role of the

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PN Junction

***This first
comprehensive
description of the
most important
material
properties and
device aspects
closes the gap
between general
books on solar
cells and journal***

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Cells Properties

***articles on chalco
genide-based
photovoltaics.***

***Written by two
very renowned
authors with
years of practical
experience in the
field, the book
covers II-VI and I-
III-VI₂ materials
as well as energy***

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Materials

***conversion at
heterojunctions.
It also discusses
the latest
semiconductor
heterojunction
models and
presents modern
analysis
concepts. Thin
film technology is
explained with an***

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***emphasis on
current and
future techniques
for mass
production, and
the book closes
with a
compendium of
failure analysis in
photovoltaic thin
film modules.
With its overview***

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***of the
semiconductor
physics and
technology
needed, this
practical book is
ideal for
students,
researchers, and
manufacturers,
as well as for the
growing number***

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***of engineers and
researchers
working in
companies and
institutes on
chalcogenide
photovoltaics.
Covering both
organic
materials, where
recent advances
in the***

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***understanding of
device physics is
driving progress,
and the newly
emerging field of
mixed halide
perovskites,
which are
challenging the
efficiencies of
conventional thin
film PV cells, this***

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Cells Properties

*book provides a
balanced
overview of the*

*experimental and
theoretical*

*aspects of these
two classes of
solar cell. The*

*book explores
both the*

*experimental and
theoretical*

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**aspects of these
solar cell
classes.**

**Emphasis is
placed on
understanding
the fundamental
physics of the
devices. The
book also
discusses
modelling over**

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Cells Properties

***many length
scales, from nano
to macro. The
first book to
cover***

***perovskites, this
is an important
reference for
industrialists and
researchers
working in
energy***

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Cells Properties
**technologies and
materials.**
Of Semiconductor
Materials

***Fundamentals of
Solar Cell Design
Fundamentals,
Technology and
Systems
From
Fundamentals to
Advanced
Applications***