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Barry P. Rand | Henning Richter

ORGANIC SOLAR CELLS

Fundamentals, Devices, and Upscaling



Organic Solar Cells Fundamentals Devices And

Wolfgang Tress

Organic Solar Cells Fundamentals Devices And:

Organic Solar Cells Barry P. Rand, Henning Richter, 2014-08-26 Organic photovoltaic OPV cells have the potential to make a significant contribution to the increasing energy needs of the future. In this book 15 chapters written by selected experts explore the required characteristics of components present in an OPV device such as transparent electrodes electron and hole conducting layers as well as elect. *Progress in High-Efficient Solution Process Organic Photovoltaic Devices* Yang Yang, Gang Li, 2015-02-17 This book presents an important technique to process organic photovoltaic devices. The basics materials aspects and manufacturing of photovoltaic devices with solution processing are explained. Solution processable organic solar cells polymer or solution processable small molecules have the potential to significantly reduce the costs for solar electricity and energy payback time due to the low material costs for the cells low cost and fast fabrication processes ambient roll to roll high material utilization etc. In addition organic photovoltaics OPV also provides attractive properties like flexibility colorful displays and transparency which could open new market opportunities. The material and device innovations lead to improved efficiency by 8% for organic photovoltaic solar cells compared to 4% in 2005. Both academic and industry research have significant interest in the development of this technology. This book gives an overview of the booming technology focusing on the solution process for organic solar cells and provides a state of the art report of the latest developments. World class experts cover fundamental materials devices and manufacturing technology of OPV technology.

Organic Electronics Stephen R. Forrest, 2020 This textbook provides a basic understanding of the principles of the field of organic electronics through to their applications in organic devices. Useful for the student and practitioner it is both a teaching text and a resource that is a jumping off point for learning working and innovating in this rapidly growing field. Provided by publisher **Organic Solar Cells** Modest Voronov, 2017 The last two decades have seen unprecedented research progress made in the fabrication and testing of organic solar cell OSC devices due to among other things rapid growth of interest in the development of organic materials for photovoltaic applications the ease of processing and the prospect of achieving high power conversion efficiency PCE cost effectively. The effects of impurity doping at the ppm level in photovoltaic organic semiconductors including i Seven nines purification of organic semiconductors ii pn control of single and co deposited organic semiconductors by impurity doping iii ionisation sensitisation of doping showing the doping efficiency of 100% iv ppm doping effects in the simplest n p homojunction organic photovoltaic cells and v the Hall effect of bulk doped organic single crystals are discussed in Chapter One. In Chapter Two the fabrication and characterisation of perovskite type solar cells are reviewed and summarised such as $\text{CH}_3\text{NH}_3\text{PbI}_3$ HC NH_2 2 PbI_3 and CsSnI_3 which are expected for solar cell materials. Chapter Three proposes an experimental method to tailor SDE and optimise the power conversion efficiency PCE based on the electrical transport curve. Chapter Four provides a brief history of organic photovoltaic cell devices factors limiting stability and power conversion efficiency fundamental parameters that have been

reported to improve the general performance of the devices and recent developments in organic solar cell devices

Organic Solar Cells Wolfgang Tress, 2014-11-22 This book covers in a textbook like fashion the basics of organic solar cells addressing 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 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 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 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 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 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 the field of organic or hybrid thin film photovoltaics. It is just as valuable for professionals and experimentalists who analyze solar cell devices.

Organic Solar Cells Wallace C.H. Choy, 2012-11-19 Organic solar cells have emerged as new promising photovoltaic devices due to their potential applications in large area, printable and flexible solar panels. *Organic Solar Cells: Materials and Device Physics* offers an updated review on the topics covering the synthesis, properties and applications of new materials for various critical roles in devices from electrodes, interface and carrier transport materials to the active layer composed of donors and acceptors. Addressing the important device physics issues of carrier and exciton dynamics and interface stability and novel light trapping structures, the potential for hybrid organic solar cells to provide high efficiency solar cells is examined and discussed in detail. Specific chapters cover key areas including: Latest research and designs for highly effective polymer donors, acceptors and interface materials; Synthesis and application of highly transparent and conductive graphene; Exciton and charge dynamics for in depth understanding of the mechanism underlying organic solar cells; New potentials and emerging functionalities of plasmonic effects in OSCs; Interface Degradation Mechanisms in organic photovoltaics; improving the entire device lifetime; Device architecture and operation mechanism of organic inorganic hybrid solar cells for next generation of high performance photovoltaics. This reference can be practically and theoretically applied by senior undergraduates, postgraduates, engineers, scientists, researchers and project managers with some fundamental knowledge in organic and inorganic semiconductor materials or devices.

Organic Solar Cells Wallace C.H. Choy, 2012-11-17 Organic solar cells have emerged as new promising photovoltaic devices due to

their potential applications in large area printable and flexible solar panels Organic Solar Cells Materials and Device Physics offers an updated review on the topics covering the synthesis properties and applications of new materials for various critical roles in devices from electrodes interface and carrier transport materials to the active layer composed of donors and acceptors Addressing the important device physics issues of carrier and exciton dynamics and interface stability and novel light trapping structures the potential for hybrid organic solar cells to provide high efficiency solar cells is examined and discussed in detail Specific chapters covers key areas including Latest research and designs for highly effective polymer donors acceptors and interface materials Synthesis and application of highly transparent and conductive graphene Exciton and charge dynamics for in depth understanding of the mechanism underlying organic solar cells New potentials and emerging functionalities of plasmonic effects in OSCs Interface Degradation Mechanisms in organic photovoltaics improving the entire device lifetime Device architecture and operation mechanism of organic inorganic hybrid solar cells for next generation of high performance photovoltaics This reference can be practically and theoretically applied by senior undergraduates postgraduates engineers scientists researchers and project managers with some fundamental knowledge in organic and inorganic semiconductor materials or devices

Parallel Processing and Applied Mathematics Roman Wyrzykowski, Ewa Deelman, Jack Dongarra, Konrad Karczewski, 2020-03-19 The two volume set LNCS 12043 and 12044 constitutes revised selected papers from the 13th International Conference on Parallel Processing and Applied Mathematics PPAM 2019 held in Bialystok Poland in September 2019 The 91 regular papers presented in these volumes were selected from 161 submissions For regular tracks of the conference 41 papers were selected from 89 submissions The papers were organized in topical sections named as follows Part I numerical algorithms and parallel scientific computing emerging HPC architectures performance analysis and scheduling in HPC systems environments and frameworks for parallel distributed cloud computing applications of parallel computing parallel non numerical algorithms soft computing with applications special session on GPU computing special session on parallel matrix factorizations Part II workshop on language based parallel programming models WLPP 2019 workshop on models algorithms and methodologies for hybrid parallelism in new HPC systems workshop on power and energy aspects of computations PEAC 2019 special session on tools for energy efficient computing workshop on scheduling for parallel computing SPC 2019 workshop on applied high performance numerical algorithms for PDEs minisymposium on HPC applications in physical sciences minisymposium on high performance computing interval methods workshop on complex collective systems Chapters Parallel adaptive cross approximation for the multi trace formulation of scattering problems and A High Order Discontinuous Galerkin Solver with Dynamic Adaptive Mesh Refinement to Simulate Cloud Formation Processes of LNCS 12043 are available open access under a Creative Commons Attribution 4 0 International License via link springer.com *Solar Cells* S. K. Sharma, Khuram Ali, 2020-01-07 This book addresses the rapidly developing class of solar cell materials and designed to provide much needed information on the

fundamental principles of these materials together with how these are employed in photovoltaic applications A special emphasize have been given for the space applications through study of radiation tolerant solar cells This book present a comprehensive research outlining progress on the synthesis fabrication and application of solar cells from fundamental to device technology and is helpful for graduate students researchers and technologists engaged in research and development of materials

Comprehensive Guide on Organic and Inorganic Solar Cells Md. Akhtaruzzaman,Vidhya

Selvanathan,2021-11-18 Comprehensive Guide on Organic and Inorganic Solar Cells Fundamental Concepts to Fabrication Methods is a one stop authoritative resource on all types of inorganic organic and hybrid solar cells including their theoretical background and the practical knowledge required for fabrication With chapters rigorously dedicated to a particular type of solar cell each subchapter takes a detailed look at synthesis recipes deposition techniques materials properties and their influence on solar cell performance including advanced characterization methods with materials selection and experimental techniques By addressing the evolution of solar cell technologies second generation thin film photovoltaics organic solar cells and finally the latest hybrid organic inorganic approaches this book benefits students and researchers in solar cell technology to understand the similarities differences benefits and challenges of each device Introduces the basic concepts of different photovoltaic cells to audiences from a wide variety of academic backgrounds Consists of working principles of a particular category of solar technology followed by dissection of every component within the architecture Crucial experimental procedures for the fabrication of solar cell devices are introduced aiding picture practical application of the technology

Organic Solar Cells Pankaj Kumar,2016-10-03 This book contains detailed

information on the types structure fabrication and characterization of organic solar cells OSCs It discusses processes to 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 to make OSCs more economical This book provides a practical guide for the fabrication processing and characterization of OSCs and paves the way for further development in OSC technology

Organic Solar

Cells Qiquan Qiao,2017-12-19 Current energy consumption mainly depends on fossil fuels that are limited and can cause environmental issues such as greenhouse gas emissions and global warming These factors have stimulated the search for alternate clean and renewable energy sources Solar cells are some of the most promising clean and readily available energy sources Plus the successful utilization of solar energy can help reduce the dependence on fossil fuels Recently organic solar cells have gained extensive attention as a next generation photovoltaic technology due to their light weight mechanical flexibility and solution based cost effective processing Organic Solar Cells Materials Devices Interfaces and Modeling provides an in depth understanding of the current state of the art of organic solar cell technology Encompassing the full spectrum of organic solar cell materials modeling and simulation and device physics and engineering this comprehensive text Discusses active layer interfacial and transparent electrode materials Explains how to relate synthesis parameters to

morphology of the photoactive layer using molecular dynamics simulations Offers insight into coupling morphology and interfaces with charge transport in organic solar cells Explores photoexcited carrier dynamics defect states interface engineering and nanophase separation Covers inorganic organic hybrids tandem structure and graphene based polymer solar cells Organic Solar Cells Materials Devices Interfaces and Modeling makes an ideal reference for scientists and engineers as well as researchers and students entering the field from broad disciplines including chemistry material science and engineering physics nanotechnology nanoscience and electrical engineering

Temperature Dependence of Polymer Photovoltaic Devices Yuko Nakazawa,2004 **Organic Solar Cells** Liming Ding,2022-02-09 Organic Solar Cells A timely and singular resource on the latest advances in organic photovoltaics Organic photovoltaics are gaining widespread attention due to their solution processability tunable electronic properties low temperature manufacture and cheap and light materials Their wide range of potential applications may result in significant near term commercialization of the technology In Organic Solar Cells Materials Design Technology and Commercialization renowned scientist Dr Liming Ding delivers a comprehensive exploration of organic solar cells including discussions of their key materials mechanisms molecular designs stability features and applications The book presents the most state of the art developments in the field alongside fulsome treatments of the commercialization potential of various organic solar cell technologies The author also provides Thorough introductions to fullerene acceptors polymer donors and non fullerene small molecule acceptors Comprehensive explorations of p type molecular photovoltaic materials and polymer polymer solar cell materials devices and stability Practical discussions of electron donating ladder type heteroacenes for photovoltaic applications In depth examinations of chlorinated organic and single component organic solar cells as well as the morphological characterization and manipulation of organic solar cells Perfect for materials scientists organic and solid state chemists and solid state physicists Organic Solar Cells Materials Design Technology and Commercialization will also earn a place in the libraries of surface chemists and physicists and electrical engineers

Nanostructured Materials for Type III Photovoltaics Peter Skabara,Mohammad Azad Malik,2017-11-08 Materials for type III solar cells have branched into a series of generic groups These include organic small molecule and polymer conjugated structures fullerenes quantum dots copper indium gallium selenide nanocrystal films dyes TiO₂ for Gr tzel cells hybrid organic inorganic composites and perovskites Whilst the power conversion efficiencies of organic solar cells are modest compared to other type III photovoltaic materials plastic semiconductors provide a cheap route to manufacture through solution processing and offer flexible devices However other types of materials are proving to be compatible with this type of processing whilst providing higher device efficiencies As a result the field is experiencing healthy competition between technologies that is pushing progress at a fast rate In particular perovskite solar cells have emerged very recently as a highly disruptive technology with power conversion efficiencies now over 20% Perovskite cells however still have to address stability and environmental issues With such a diverse range of materials it is timely to capture

the different technologies into a single volume of work This book will give a collective insight into the different roles that nanostructured materials play in type III solar cells This will be an essential text for those working with any of the devices highlighted above providing a fundamental understanding and appreciation of the potential and challenges associated with each of these technologies Organic and Hybrid Solar Cells Hui Huang,Jinsong Huang,2014-11-25 This book delivers a comprehensive evaluation of organic and hybrid solar cells and identifies their fundamental principles and numerous applications Great attention is given to the charge transport mechanism donor and acceptor materials interfacial materials alternative electrodes device engineering and physics and device stability The authors provide an industrial perspective on the future of photovoltaic technologies Fundamentals of Solar Cell Design Inamuddin,Mohd Imran Ahamed,Rajender Boddula,Mashallah Rezakazemi,2021-07-30 Edited by one of the most well respected and prolific engineers in the world and his team this book provides a comprehensive overview of solar cells and explores the history of evolution and present scenarios of solar cell design classification properties various semiconductor materials thin films wafer scale transparent solar cells and other fundamentals of solar cell design 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 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 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 harvested energy from the sun's light radiation into electricity are in an ever growing demand for future global energy production Solar cell based energy harvesting has attracted worldwide attention for its notable features such as cheap renewable technology scalable lightweight flexibility versatility no greenhouse gas emission and economy friendly and operational costs Thus solar cell technology is at the forefront of renewable energy technologies which are used in telecommunications power plants small devices to satellites Large scale implementation can be manipulated by various types used in solar cell 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 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 conversion efficiencies applications and patents This outstanding new volume Provides state of the art information about solar cells Is a unique reference guide for researchers in solar energy Includes novel innovations in the field of solar cell technology Audience This book is a unique reference guide that can be used by

faculty students researchers engineers device designers and industrialists who are working and learning in the fields of semiconductors chemistry physics electronics light science material science flexible energy conversion industrial and renewable energy sectors *Fundamentals and Applications of Solar Energy, Part II* Ihab H. Farag,Stephen S. Melsheimer,1981

Science ,2011 **Fundamentals and Applications of Solar Energy** ,1980

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