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Henning Richter | Barry P. Rand

ORGANIC SOLAR CELLS

Fundamentals, Devices, and Upscaling



Organic Solar Cells Fundamentals Devices And

Dibya Prakash Rai



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, 2015-02-26 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 and Hybrid Solar Cells Lukas Schmidt-Mende, Stefan Kraner, Azhar Fakharuddin, 2022-08-01 With the increasing world energy demand there is a growing necessity for clean and renewable energy This book offers an introduction to novel types of solar cells which are processed from solution We discuss fabrication different architectures and their device physics of these solar cells on the bases of the author s teaching course on a master degree level A comparison with conventional solar cells is given and the specialties of organic hybrid and perovskite solar cells are emphasized

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](https://www.springer.com)

Advanced Materials and Nano Systems: Theory and Experiment - Part 2 Dibya Prakash Rai, 2022-09-30 The discovery of new materials and the manipulation of their exotic properties for device fabrication is crucial for advancing technology. Nanoscience and the creation of nanomaterials have taken materials science and electronics to new heights for the benefit of mankind. Advanced Materials and Nanosystems: Theory and Experiment covers several topics of nanoscience research. The compiled chapters aim to update students, teachers, and scientists by highlighting modern developments in materials science theory and experiments. The significant role of new materials in future technology is also demonstrated. The book serves as a reference for curriculum development in technical institutions and research programs in the field of physics, chemistry, and applied areas of science like materials science, chemical engineering, and electronics. This part covers 12 topics in these areas: Recent advancements in nanotechnology, a human health Perspective, An exploratory study on characteristics of SWIRL of AlGaAs/GaAs in advanced bio-based nanotechnological systems, Electronic structure of the half-Heusler ScAuSn, LuAuSn, and their superlattice, Recent trends in nanosystems, Improvement of performance of single and multicrystalline silicon solar cell using low temperature surface passivation layer and antireflection coating, Advanced materials and nanosystems, Effect of nanostructure materials on optical properties of some rare earth ions doped in silica matrix, Nd₂Fe₁₄B and SmCO₅ a permanent magnet for magnetic data storage and data transfer technology, Visible light induced photocatalytic activity of MWCNTS decorated sulfide based nano photocatalysts, Organic solar cells, Neodymium doped lithium borosilicate glasses, Comprehensive quantum mechanical study of structural features, reactivity, molecular properties, and wave function based characteristics of capmatinib.

Polymer Photovoltaics Fei Huang, Hin-Lap Yip, Yong Cao, 2016 An international perspective on the latest research in polymer solar cell technology

Nanostructured Materials for Type III Photovoltaics Mohammad Azad Malik, Peter Skabara, 2017-11-08 This book will give a collective insight into the different roles that nanostructured materials play in Type III solar cells

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

Fundamentals of Solar Cell Design Inamuddin, Mohd Imran Ahamed, Rajender Boddula, Mashallah Rezakazemi, 2021-08-24 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

Nanomaterials for Innovative Energy Systems and Devices Zishan H. Khan, 2022-05-24 This book covers the latest research on applications of nanomaterials in the field of energy systems and devices It provides an overview of the state of art research in this rapidly developing field It discusses the design and fabrication of nanostructured materials and their energy applications Various topics covered include nanomaterials for perovskite solar cells transition metal dichalcogenides TMDs nanocomposites based supercapacitors battery materials and technologies major challenges toward development of efficient thermoelectric materials for energy efficient devices extraction and experimentation of biodiesel produced from leachate oils of landfills

coupled with nano additives aluminium oxide and copper oxide on diesel engine and many more It has contributions from world renowned specialists in the fields of nanomaterials and energy devices The book will be useful for students researchers and professionals working in the area of nanomaterials and energy systems devices *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 ionization sensitization 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 characterization of perovskite type solar cells are reviewed and summarized such as $\text{CH}_3\text{NH}_3\text{PbI}_3$ HCNH_2 2PbI_3 and CsSnI_3 which are expected for solar cell materials Chapter Three proposes an experimental method to tailor SDE and optimize 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 **Modelling and Design of Nanostructured Optoelectronic Devices**

Jagdish A. Krishnaswamy, Praveen C. Ramamurthy, Gopalkrishna Hegde, Debiprosad Roy Mahapatra, 2022-04-02 This book approaches the design of functionally superior optoelectronic devices through the use of bio inspired nanostructures and multiscale material structures through a step by step approach The book combines both the fundamental theoretical concepts involved in understanding and numerically modelling optoelectronic devices and the application of such methods in addressing challenging research problems in nanostructured optoelectronic design and fabrication The book offers comprehensive content in optoelectronic materials and engineering and can be used as a reference material by researchers in nanostructured optoelectronic design **Perovskite-Based Solar Cells** Saida Laalioui, 2022-02-21 Perovskite Based Solar Cells From Fundamentals to Tandem Devices gives fundamental understanding of perovskite solar cells from the chemical composition of each thin layer composing the different stacks to the whole device Special attention has been given to the development of the materials forming the perovskite solar cell and their effect on the device performance in addition to the recent progress of this emerging technology Moreover light has been shed on the perovskite elaboration techniques in addition to the several techniques proposed to improve both the efficiency and the stability of perovskite solar cells Furthermore special emphasis was given to the three types of tandem solar cells and their recent advances starting from Perovskite perovskite tandem solar cells to Perovskite CIGS tandem cells to perovskite heterojunction silicon tandem solar

cells The latter constitute a promising solution to improve photovoltaic solar cells performance

Springer Handbook of Semiconductor Devices Massimo Rudan, Rossella Brunetti, Susanna Reggiani, 2022-11-10 This Springer Handbook comprehensively covers the topic of semiconductor devices embracing all aspects from theoretical background to fabrication modeling and applications Nearly 100 leading scientists from industry and academia were selected to write the handbook's chapters which were conceived for professionals and practitioners material scientists physicists and electrical engineers working at universities industrial R D and manufacturers Starting from the description of the relevant technological aspects and fabrication steps the handbook proceeds with a section fully devoted to the main conventional semiconductor devices like e g bipolar transistors and MOS capacitors and transistors used in the production of the standard integrated circuits and the corresponding physical models In the subsequent chapters the scaling issues of the semiconductor device technology are addressed followed by the description of novel concept based semiconductor devices The last section illustrates the numerical simulation methods ranging from the fabrication processes to the device performances Each chapter is self contained and refers to related topics treated in other chapters when necessary so that the reader interested in a specific subject can easily identify a personal reading path through the vast contents of the handbook

Solar Cells Based on Colloidal Nanocrystals Holger Borchert, 2014-04-01 This book presents a new system of solar cells Colloidal nanocrystals possess many physical and chemical properties which can be manipulated by advanced control over structural features like the particle size One application field is photovoltaics where colloidal semiconductor nanocrystals are explored as components of photo active layers which can be produced from liquid media often in combination with conductive polymers The further development of this interdisciplinary field of research requires a deep understanding of the physics and chemistry of colloidal nanocrystals conducting polymers and photovoltaic devices This book aims at bridging gaps between the involved scientific disciplines and presents important fundamentals and the current state of research of relevant materials and different types of nanoparticle based solar cells The book will be of interest to researchers and PhD students Moreover it may also serve to accompany specialized lectures in related areas

Advanced Materials for Printed Flexible Electronics Colin Tong, 2021-10-04 This book provides a comprehensive introduction to printed flexible electronics and their applications including the basics of modern printing technologies printable inks performance characterization device design modeling and fabrication processes A wide range of materials used for printed flexible electronics are also covered in depth Bridging the gap between the creation of structure and function printed flexible electronics have been explored for manufacturing of flexible stretchable wearable and conformal electronics device with conventional 3D and hybrid printing technologies Advanced materials such as polymers ceramics nanoparticles 2D materials and nanocomposites have enabled a wide variety of applications such as transparent conductive films thin film transistors printable solar cells flexible energy harvesting and storage devices electroluminescent devices and wearable sensors This book provides students

researchers and engineers with the information to understand the current status and future trends in printed flexible electronics and acquire skills for selecting and using materials and additive manufacturing processes in the design of printed flexible electronics *Synchrotron Radiation in Materials Science* Chunhai Fan,Zhentang Zhao,2018-05-29 Meeting the long felt need for in depth information on one of the most advanced material characterization methods a top team of editors and authors from highly prestigious facilities and institutions covers a range of synchrotron techniques that have proven useful for materials research Following an introduction to synchrotron radiation and its sources the second part goes on to describe the various techniques that benefit from this especially bright light including X ray absorption diffraction scattering imaging and lithography The third and final part provides an overview of the applications of synchrotron radiation in materials science bridging the gap between specialists in synchrotron research and material scientists this is a unique and indispensable resource for academic and industrial researchers alike **Fundamentals of Photovoltaic Modules and Their Applications**

G. N. Tiwari,Swapnil Dubey,2010 Presently there is no single publication available which covers the topics related to photovoltaic PV or photovoltaic thermal PV T technologies thermal modelling CO₂ mitigation and carbon trading This book disseminates the current knowledge in the fundamentals of solar energy photovoltaic PV or photovoltaic thermal PV T technologies energy security and climate change and is aimed at undergraduate and postgraduate students and professionals The main emphasis of the book is on the design construction performance and application of PV and PV T from the electricity and thermal standpoint Hot topics covered in the book include energy security of a nation climate change CO₂ mitigation and carbon credit earned by using PV or PV T technologies Carbon Trading This information will prove helpful in filling the gap between the researchers and professionals working on the application of photovoltaic and global climate change It also covers economic cost effective and sustainable aspects of photovoltaic technologies The book gives a detailed history of the new technological developments in PV T systems worldwide with system photographs and references and elaborates on the fundamentals of hybrid systems and their performances with thermal modelling Energy and exergy analysis techno economic analysis and carbon trading are key chapters for research professionals The book also includes important case studies to aid understanding of the subject for all readers *Scanning Probe Microscopy For Energy Research: Materials, Devices, And Applications*

Dawn Bonnell,Sergei V Kalinin,2013-03-26 Efficiency and life time of solar cells energy and power density of the batteries and costs of the fuel cells alike cannot be improved unless the complex electronic optoelectronic and ionic mechanisms underpinning operation of these materials and devices are understood on the nanometer level of individual defects Only by probing these phenomena locally can we hope to link materials structure and functionality thus opening pathway for predictive modeling and synthesis While structures of these materials are now accessible on length scales from macroscopic to atomic their functionality has remained Terra Incognita In this volume we provide a summary of recent advances in scanning probe microscopy studies of local functionality of energy materials and

devices ranging from photovoltaics to batteries fuel cells and energy harvesting systems Recently emergent SPM modes and combined SPM electron microscopy approaches are also discussed Contributions by internationally renowned leaders in the field describe the frontiers in this important field

Plasmonic Organic Solar Cells Bo Wu, Nripan Mathews, Tze-Chien Sum, 2016-10-04 This book explores the incorporation of plasmonic nanostructures into organic solar cells which offers an attractive light trapping and absorption approach to enhance power conversion efficiencies The authors review the latest advances in the field and discuss the characterization of these hybrid devices using a combination of optical and electrical probes Transient optical spectroscopies such as transient absorption and transient photoluminescence spectroscopy offer powerful tools for observing charge carrier dynamics in plasmonic organic solar cells In conjunction with device electrical characterizations they provide unambiguous proof of the effect of the plasmonic nanostructures on the solar cells performance However there have been a number of controversies over the effects of such integration where both enhanced and decreased performance have been reported Importantly the new insights into the photophysics and charge dynamics of plasmonic organic solar cells that these spectroscopy methods yield could be used to resolve these controversies and provide clear guidelines for device design and fabrication

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