Oled Display And Oled Lighting Technology And

This book offers a wealth of knowledge and information about the fundamental and practical aspects of flexible organic light-emitting diode (OLED) devices. The book provides an overview of these devices by considering their merits and business potential, the history of their research and development, the fundamental technology, and required properties for materials, devices, processes, and future trends of flexible OLED devices. The practical sections describe novel, cutting-edge expertise for flexible substrates, gas barriers, encapsulation, novel electrodes, and on-demand patterning for OLED devices. Applications of the technologies of ultra-thin glass, stainless steel foil, and barrier films are described as flexible substrates. The book also explains features such as dry-barrier layers, wet-barrier layers, multi-layer barrier structures, dam-fill encapsulation, thin film encapsulation (TFE), and laminating encapsulation. In addition, there are explanations of novel electrodes and on-demand ink-jet patterning, both of which are applicable to flexible OLED devices. As the novel electrodes, transparent conducting polymer, silver nanowire (AgNW), metal-mesh and roll-to-roll (R2R) process technologies are included. The know-how that is described here is applicable to flexible devices, not only for OLEDs, OPVs, OTFTs, and others but also for sensors, wearable devices, robots, and healthcare devices. The information contained in this valuable book is useful for all scientists, engineers, and managers who are interested in the field of flexible devices.

Compared to traditional electrical filaments, arc lamps, and fluorescent lamps, solid-state lighting offers higher efficiency, reliability, and environmentally friendly technology. LED / solid-state lighting is poised to take over conventional lighting due to cost savings—there is pretty much no debate about this. In response to the recent activity in this field, Fundamentals of Solid-State Lighting: LEDs, OLEDs, and Their Applications in Illumination and Displays covers a range of solid-state devices, technologies, and materials used for lighting and displays. It also examines auxiliary but critical requirements of efficient applications, such as modeling, thermal management, reliability, and smart lighting. The book discusses performance metrics of LEDs such as efficiency, efficacy, current-voltage characteristics, optical parameters like spectral distribution, color temperature, and beam angle before moving on to luminescence theory, injection luminescence, radiative and non-radiative recombination mechanisms, recombination rates, carrier lifetimes, and related topics. This lays down the groundwork for understanding LED operation. The book then discusses energy gaps, light emission, semiconductor material, special equipment, and laboratory facilities. It also covers production and applications of high-brightness LEDs (HBLEDs) and organic LEDs (OLEDs). LEDs represent the landmark development in lighting since the invention of electric lighting, allowing us to create unique, low-energy lighting solutions, not to talk about their minor maintenance expenses. The rapid strides of LED lighting technology over the last few years have changed the dynamics of the global lighting market, and LEDs are expected to be the mainstream light source in the near future. In a nutshell, the book traces the advances in LEDs, OLEDs, and their applications, and presents an up-to-date and analytical perspective of the scenario for audiences of different backgrounds and interests.

Organic light-emitting diodes (OLEDs) are opening up exciting new applications in the area of lighting and displays. OLEDs are self emissive and by careful materials and device design can generate colours across the visible spectrum. Together with simple monolithic fabrication on a range of different substrates, these diverse material properties give OLEDs key advantages over existing display and lighting technology. This important book summarises key research on materials, engineering and the range of applications of these versatile materials. Part one covers materials for OLEDs. Chapters review conjugated polymers, transparent conducting thin films, iridium complexes and phosphorescent materials. Part two discusses the operation and engineering of OLED devices. Chapters discuss topics such as highly efficient pin-type OLEDs, amorphous organic semiconductors, nanostructuring techniques, light extraction, colour tuning, printing techniques, fluorenone defects and disruptive characteristics as well as durability issues. Part three explores the applications of OLEDs in displays and solid-state lighting. Applications discussed include displays, microdisplays and transparent OLEDs, sensors and large-area OLED lighting panels. Organic light-emitting diodes (OLEDs) is a standard reference for engineers working in lighting, display technology and the consumer electronics sectors, as well as those researching OLEDs. Summarises key research on the materials, engineering and applications of OLEDs Reviews conjugated polymers, transparent conducting thin films Considers nanostructuring OLEDS for increasing levels of efficiency

This book explores the principles, design, and image processing of multi-primary displays, and introduces the reader to the intricacies of the typical imaging pathways which influence display design and the perception of color within a display system. Early chapters introduce the concepts behind human perception, color science, and lighting, which are necessary to fully understand multi-primary displays. The reader is also introduced to digital capture and transmission systems to better understand the ecosystem in which multi-primary displays exist. Subsequent chapters introduce the reader to current display technologies, including LCD, OLED, and inorganic LED displays. The working principles, performance, and upcoming advances are discussed for each of these technologies to provide the reader with a clear understanding of the tradeoffs which are necessary when considering multi-primary displays. This discussion is followed by an in-depth discussion of the image processing technology necessary to implement multi-primary displays. The book concludes with chapters that clearly discuss the advantages and limitations of multi-primary displays for direct view, virtual reality, and augmented reality displays. The book provides a broad viewpoint across the entire display ecosystem, explaining the interactions among system components to provide a rationale for the further development of multi-primary displays. Whether the reader is interested in broadening their understanding of display systems or the development of multi-primary displays, the text provides and understandable and practical summary of important display system concepts.

Efficient Organic Light Emitting Diodes (OLEDs)

Organic Light-Emitting Diodes (OLEDs)

Fundamentals of Solid-State Lighting

Printed Electronics

Active-Matrix Organic Light- Emitting Display Technologies

Limited availability of grid-based electricity is a major challenge faced by many developing countries, particularly the rural population. Fuel-based lighting, such as the kerosene lantern, is widespread in these areas, but it is a poor alternative, contributing to global warming and causing serious health problems. Several developing countries are therefore now encouraging the use of sustainable lighting. Solar Lighting gives an in-depth analysis of energy-efficient light production through the use of solar-powered LED systems. The authors pay particular attention to the interplay between energy transformation and device efficiency. They also discuss diverse aspects of renewable energy, including how an improvement in the efficiency of appliances can reduce the cost of energy. Solar Lighting is written for physicists, environmental experts and lighting engineers. It is also suitable for undergraduate students in the fields of environmental science, electrical engineering and renewable energy.

This book puts Organic Light Emitting Transistors (OLETs) in the context of organic electronics and photonics, exploring devices' physics principles, the properties of currently available materials, processing and fabrication techniques, and the different approaches adopted to structure the active channel and to control organic and hybrid interfaces. Major applications in different fields as well as the industry's roadmap for future implementation are also reviewed in detail.

The essential resource that offers a comprehensive understanding of OLED optimizations Highly Efficient OLEDs. Materials Based on Thermally Activated Delayed Fluorescence (TADF) offers substantial information on the working principle of OLEDs and on new types of emitting materials (organic and inorganic). As the authors explain, OLEDs that use the Singlet-Harvesting mechanism based on the molecular property of TADF work according to a new exciton harvesting principle. Thus, low-cost emitter materials, such as Cu(I) or Ag(I) complexes as well as metal-free organic molecules, have the potential to replace high-cost rare metal complexes being currently applied in OLED technology. With contributions from an international panel of experts on the topic, the text shows how the application of new TADF materials allow for the development of efficient OLED displays and lighting systems. This new mechanism is the gateway to the third-generation of luminescent materials. This important resource: Offers a state-of-the-art compilation of the latest results in the dynamically developing field of OLED materials Is edited by a pioneer in the field of OLED material technology Contains a detailed application-oriented guide to new low-cost materials for displays and lighting Puts the focus on the emerging fields of OLED technology Written for materials scientists, solid state chemists, solid state physicists, and electronics engineers, Highly Efficient OLEDs. Materials Based on Thermally Activated Delayed Fluorescence offers a comprehensive resource to the latest advances of OLEDs based on new TADF materials.

Following two decades of intense research globally, the organic light-emitting diode (OLED) has steadily emerged as the ultimate display technology of choice for the coming decades. Portable active matrix OLED displays have already become prevalent, and even large-sized ultra-high definition 4K TVs are being mass-produced. More exotic applications such as wearable displays have been commercialized recently. With the burgeoning success in displays, researchers are actively bringing the technology forward into the exciting solid-state lighting market. This book presents the knowledge needed for students and researchers from diverse disciplines to understand the underlying principles in OLED technology. It begins with a brief history and fundamental working principles of OLEDs. After introducing the fundamentals, it discusses more efficient OLED designs, as well as advanced strategies to enhance the performance. The text covers in detail important areas such as top-emission, p- and n-type doping, device stability, light extraction, and stacked white OLEDs. It also throws light on the current industry practice and major areas of focus in the near future.

Application of Developed APCVD Transparent Conducting Oxides and Undercoat Technologies for Economical OLED Lighting

Materials Based on Thermally Activated Delayed Fluorescence

Organic Electroluminescence

Nanogap Electrodes

Handbook of Organic Materials for Optical and (Opto)Electronic Devices

Polymers for Light-Emitting Devices and Displays provides an in-depth overview of fabrication methods and unique properties of polymeric semiconductors, and their potential applications for LEDs including organic electronics, displays, and optoelectronics. Some of the chapter subjects include: • The newest polymeric materials and processes beyond the classical structure of PLED • Conjugated polymers and their application in the light-emitting diodes (OLEDs & PLEDs) as optoelectronic devices. • The novel work carried out on electrospun nanofibers used for LEDs. • The roles of diversified architectures, layers, components, and their structural modifications in determining efficiencies and parameters of PLEDs as high-performance devices. • Polymer liquid crystal devices (PLCs), their synthesis, and applications in various liquid crystal devices (LCs) and displays. • Reviews the state-of-art of materials and technologies to manufacture hybrid white light-emitting diodes based on inorganic light sources and organic wavelength converters.

Cover -- Title Page -- Copyright -- Contents -- List of Contributors -- Series Preface -- Preface -- Acknowledgments -- About the Editor -- Chapter 1 Principles of Solid State Luminescence -- 1.1 Introduction to Radiation from an Accelerating Charge -- 1.2 Radiation from an Oscillating Dipole -- 1.3 Quantum Description of an Electron during a Radiation Event -- 1.4 The Exciton -- 1.5 Two-Electron Atoms -- 1.6 Molecular Excitons -- 1.7 Band-to-Band Transitions -- 1.8 Photometric Units -- 1.9 The Light Emitting Diode -- References -- Chapter 2 Quantum Dots for Displays and Solid State Lighting -- 2.1 Introduction -- 2.2 Nanostructured Materials -- 2.3 Quantum Dots -- 2.3.1 History of Quantum Dots -- 2.3.2 Structure and Properties Relationship -- 2.3.3 Quantum Confinement Effects on Band Gap -- 2.4 Relaxation Process of Excitons -- 2.4.1 Radiative Relaxation -- 2.4.2 Nonradiative Relaxation Process -- 2.5 Blinking Effect -- 2.6 Surface Passivation -- 2.6.1 Organically Capped QDs -- 2.6.2 Inorganically Passivated QDs -- 2.7 Synthesis Processes -- 2.7.1 Top-Down Synthesis -- 2.7.2 Bottom-Up Approach -- 2.8 Optical Properties and Applications -- 2.8.1 Displays -- 2.8.2 Solid State Lighting -- 2.8.3 Biological Applications -- 2.9 Perspective -- Acknowledgments -- References -- Chapter 3 Color Conversion Phosphors for Light Emitting Diodes -- 3.1 Introduction -- 3.2 Disadvantages of Using LEDs Without Color Conversion Phosphors -- 3.3 Phosphors for Converting the Color of Light Emitted by LEDs -- 3.3.1 General Considerations -- 3.3.2 Requirements of Color Conversion Phosphors -- 3.3.3 Commonly Used Activators in Color Conversion Phosphors -- 3.3.4 Strategies for Generating White Light from LEDs -- 3.3.5 Outstanding Problems with Color Conversion Phosphors for LEDs

Small molecules and conjugated polymers, the two main types of organic materials used for optoelectronic and photonic devices, can be used in a number of applications including organic light-emitting diodes, photovoltaic devices, photorefractive devices and waveguides. Organic materials are attractive due to their low cost, the possibility of their deposition from solution onto large-area substrates, and the ability to tailor their properties. The Handbook of organic materials for optical and (opto)electronic devices provides an overview of the properties of organic optoelectronic and nonlinear optical materials, and explains how these materials can be used across a range of applications. Parts one and two explore the materials used for organic optoelectronics and nonlinear optics, their properties, and methods of their characterization illustrated b physical studies. Part three moves on to discuss the applications of optoelectronic and nonlinear optical organic materials in devices and includes chapters on organic solar cells, electronic memory devices, and electronic chemical sensors, electro-optic devices. The Handbook of organi materials for optical and (opto)electronic devices is a technical resource for physicists, chemists, electrical engineers and materials scientists involved in research and development of organic semiconductor and nonlinear optical materials and devices. Comprehensively examines the properties of organic optoelectronic and nonlinear optical materials Discusses their applications in different devices including solar cells, LEDs and electronic memory devices An essential technical resource for physicists, chemists, electrical engineers and materials scientists

A Comprehensive Source for Taking on the Next Stage of OLED R&D OLED Fundamentals: Materials, Devices, and Processing of Organic Light-Emitting Diodes brings together key topics across the field of organic light-emitting diodes (OLEDs), from fundamental chemistry and physics to practical materials science and engineering aspects to design and manufacturing factors. Experts from top academic institutions, industry, and national laboratories provide thorough, up-to-date coverage on the most useful materials, devices, and design and fabrication methods for high-efficiency lighting. The first part of the book covers all the construction materials of OLED devices, from substrate to encapsulation. For the first time in book form, the second part addresses challenges in devices and processing, including architectures and methods for new OLED lighting and display technologies. The book is suitable for a broad audience, including materials scientists, device physicists, synthetic chemists, and electrical engineers. It can also serve as an introduction for graduate students interested in applied aspects of photophysics a electrochemistry in organic thin films.

Assessment of Solid-State Lighting, Phase Two

OLED Displays and Lighting

Thermally Activated Delayed Fluorescence Organic Light-Emitting Diodes (TADF-OLEDs)

OLED Microdisplays

This new edition specifically addresses the most recent and relevant developments in the design and manufacture of OLED displays Provides knowledge of OLED fundamentals and related technologies for applications such as displays and solid state lighting along with processing and manufacturing technolo as a reference for people engaged in OLED research, manufacturing, applications and marketing Includes coverage of white + color filter technology, which has become industry standard technology for large televisions

The OLED Handbook is a comprehensive guide to OLED technology, industry and market - brought to you by OLED-Info (Edition 2020). The OLED Handbook provides a great introduction to the world of OLEDs and covers everything you need to know about the OLED industry, market and technology. It is an invaluable guide for display engineers, business developers, researchers, equipment vendors, OLED material companies, private investors and anyone who wants to learn more about OLEDs today and in the future.

The Green Electronics book is intended to stimulate people's thinking toward the new concepts of an environment-friendly electronics - the main challenge in the future. The book offers multiple solutions to push the classical electronic industry toward green concepts, aided by nanotechnologies, with revolution features that provide low power consumption in electronics, use biomaterials for integrated structures, and include environmental monitoring tools. Based on organic semiconductors/insulators without toxic precursors, green electronic technologies launched promising devices like OLED, OTFT, or nano-core-sh transistors. The Green Electronics book successfully presents the recent directions collected worldwide and leaves free space for continuing year by year with new subtopics.

This book provides a comprehensive and up-to-date guide to the AMOLED technologies and applications which have become industry standard in a range of devices, from small mobile displays to large televisions. Unlike other books on the topic, which cover the fundamentals, materials, processing, and manu OLEDs, this one-stop book discusses the core components, such as TFT backplanes, OLED materials and devices, and driving schematics together in one volume with chapters written by experts from leading international companies in the field of OLED materials and OLED TVs. It also examines emerging ar micro-LEDs, displays using quantum dots, and AR & VR displays. Presenting the latest research trends as well as the basic principles of each topic, this book is intended for undergraduate and postgraduate students taking display-related courses, new researchers, and engineers in related fields.

LEDs, OLEDs, and Their Applications in Illumination and Displays

The OLED Handbook (2019 edition)

Organic Light Emitting Diode (OLED) Displays

Green Electronics

Next Generation Self-Emitting Displays

This book details flexible glass properties that enable use in emerging electronic and opto-electronic applications. Discussion includes flexible glass advantages compared to alternative substrate materials. Examples describe flexible glass in processes such as vacuum deposition, monolithic integration, printing, and roll-to-roll. Flexible glass demonstrations in emerging applications such as photovoltaics, flexible displays, and optical interconnects are also detailed. The reader will find in this unique book: Discussion of flexible glass processing and mechanical reliability. Demonstration of flexible glass in roll-to-roll (R2R) fabrication processes. Flexible glass substrate examples in displays, sensors, and photovoltaics. Flexible glass ecosystem description for identification of new applications.

Organic light-emitting diode(OLED) technology has achieved significant penetration in the commercial market for small, low-voltage and inexpensive displays. Present and future novel technologies based on OLEDs involve rigid and flexible flat panel displays, solid-state lighting, and lasers. Display applications may range from hand-held devices to large flat panel screens that can be rolled up or hung flat on a wall or a ceiling. Organic Electroluminescence gives an overview of the on-going research in the field of organic light-emitting materials and devices, covering the principles of electroluminescence in organic thin films, as well as recent trends, current applications, and future potential uses. The book begins by giving a background of organic electroluminescence in terms of history and basic principles. It offers details on the mechanism(s) of electroluminescence in thin organic films. It presentsin-depth discussions of the parameters that control the external electroluminescence quantum efficiency including the photoluminescence quantum yield, the light-output coupling factor, carrier/charge injection and transport, and electron and hole recombination processes in organic semiconductors. The authors address the design and the characterization of amorphous charge transport materials with high glass transition temperatures, light-emitting small molecules and conjugated polymers. The book covers state-of-the-art concepts and technologies such as fluorescent and phosphorescent OLEDs, various approaches for patterning organics, and active matrix organic emissive displays including their back panel thin film transistors and pixel electronics. It concludes by summarizing future directions for OLEDs in organic light-emitting displays, large area distributed solid state light sources, and lasers using organic thin films, nanostructures, and photonic crystals. Organic Electroluminescence is an excellent resource and reference for stu

This book provides an overview of the newly emerged and highly interdisciplinary field of printed electronics • Provides an overview of the latest developments and research results in the field of printed electronics • Topics addressed include: organic printable electronic materials, inorganic printable electronic materials, printing processes and equipments for electronic manufacturing, printable transistors, printable photovoltaic devices, printable lighting and display, encapsulation and packaging of printed electronic devices, and applications of printed electronics • Discusses the principles of the above topics, with support of examples and graphic illustrations • Serves both as an advanced introductory to the topic and as an aid for professional development into the new field • Includes end of chapter references and links to further reading

Thermally Activated Delayed Fluorescence Organic Light-Emitting Diodes (TADF-OLEDs) comprehensively introduces the history of TADF, along with a review of fundamental concepts. Then, TADF emitters with different colors, such as blue, green, red and NIR as well as white OLEDs are discussed in detail. Other sections cover exciplex-type TADF materials, emerging application of TADF emitters as a host in OLEDs, and applications of TADF materials in organic lasers and biosensing. Discusses green, blue, red, NIR and white TADF emitters and their design strategies for improved performance for light-emitting diode applications Addresses emerging materials, such as molecular and exciplex-based TADF materials Includes emerging applications like lasers and biosensors

Materials, Devices, and Processing of Organic Light-Emitting Diodes

Towards the Next Generation Display Technology

Advanced Display Technology

Organic Light-Emitting Transistors

Color in Electronic Display Systems

An extensive introduction to the engineering and manufacture of current and next-generation flat panel displays This book provides a broad overview of the manufacturing of flat panel displays, with a particular emphasis on the display systems at the forefront of the current mobile device revolution. It is structured to cover a broad spectrum of topics within the unifying theme of display systems manufacturing. An important theme of this book is treating displays as systems, which expands the scope beyond the technologies and manufacturing of traditional display panels (LCD and OLED) to also include key components for mobile device applications, such as flexible OLED, thin LCD backlights, as well as the manufacturing of display module assemblies. Flat Panel Display Manufacturing fills an important gap in the current book literature describing the state of the art in display manufacturing for today's displays, and looks to create a reference the development of next generation displays. The editorial team brings a broad and deep perspective on flat panel display manufacturing, with a global view spanning decades of experience at leading institutions in Japan, Korea, Taiwan, and the USA, and including direct pioneering contributions to the development of displays. The book includes a total of 24 chapters contributed by experts at leading manufacturing institutions from the global FPD industry in Korea, Japan, Taiwan, Germany, Israel, and USA. Provides an overview of the evolution of display technologies and manufacturing Treats display products as systems with manifold applications, expanding the scope

beyond traditional display panel manufacturing to key components for mobile devices and TV applications Provides a detailed overview of LCD manufacturing, including panel architectures, process flows, and module manufacturing Provides a detailed overview of OLED manufacturing for both mobile and TV applications, including a chapter dedicated to the young field of flexible OLED manufacturing Provides a detailed overview of the key unit processes and corresponding manufacturing equipment, including manufacturing test & repair of TFT array panels as well as display module inspection & repair Introduces key topics in display manufacturing science and engineering, including productivity & quality, factory architectures, and green manufacturing Flat Panel Display Manufacturing will appeal to professionals and engineers in R&D departments for display-related technology development, as well as to graduates and Ph.D. students specializing in LCD/OLED/other flat panel displays.

Quantum dot-based light emitting diodes were assigned to bringing together the latest and most important progresses in light emitting diode (LED) technologies. In addition, they were dedicated to gain the perspective of LED technology for all of its advancements and innovations due to the employment of semiconductor nanocrystals. Highly selective, the primary aim was to provide a visual source for high-urgency work that will define the future directions relating to the organic light emitting diode (OLED), with the expectation for lasting scientific and technological impact. The editor hopes that the chapters verify the realization of the mentioned aims that have been considered for editing of this book. Due to the rapidly growing OLED technology, we wish this book to be useful for any progress that can be achieved in future.

Principles and Applications of Organic Light Emitting Diodes (OLEDs)explores the ways in which the development of organic semiconductor materials is opening up new applications in electronic and optoelectronic luminescent devices. The book begins by covering the principles of luminescence and the luminescent properties of organic semiconductors. It then covers the development of luminescent materials for OLEDs, discussing the advantages and disadvantages of organic versus inorganic luminescent materials. The fabrication and characterization of OLEDs is also covered in detail, including information on, and comparisons of, vacuum deposition and solution techniques. Finally, applications of OLEDs are explored, including OLEDs in solid-state lighting, colored lighting, displays and potential future applications, such as ultra-thin and flexible technologies. This book is an excellent resource both for experts and newcomers to the field of organic optoelectronics and OLEDs. It is ideal for scientists working on optical devices, lighting, display and imaging technologies, and for all those engaged in research in photonics, luminescence and optical materials.

Provides a one-stop guide to OLED technology for the benefit of newcomers to the field of organic optoelectronics Comprehensively covers the luminescent properties of organic semiconductors and their development into OLED materials Offers practical information on OLED fabrication and their applications in solid-state lighting and displays, making this essential reading for optoelectronics engineers and materials scientists

The OLED Handbook is a comprehensive guide to OLED technology, industry and market - brought to you by OLED-Info (Edition 2019). The OLED Handbook provides a great introduction to the world of OLEDs and covers everything you need to know about the OLED industry, market and technology. It is an invaluable guide for display engineers, business developers, researchers, equipment vendors, OLED material companies, private investors and anyone who wants to learn more about OLEDs today and in the future.

Polymers for Light-emitting Devices and Displays

Materials, Devices and Applications

Flexible Glass

Quantum-dot Based Light-emitting Diodes

Device and Process Technology for Full-color Active-matrix OLED Displays

Unique in its scope, this book comprehensively combines various synthesis strategies with applications for nanogap electrodes. Clearly divided into four parts, the monograph begins with an introduction to molecular electronics and electron transport in molecular junctions, before moving on to a whole section devoted to synthesis and characterization. The third part looks at applications with single molecules or self-assembled monolayers, and the whole is rounded off with a section on interesting phenomena observed using molecular-based devices.

Economics is a key factor for application of organic light emitting diodes (OLED) in general lighting relative to OLED flat panel displays that can handle high cost materials such as indium tin oxide (ITO) or Indium zinc oxide (IZO) as the transparent conducting oxide (TCO) on display glass. However, for OLED lighting to penetrate into general illumination, economics and sustainable materials are critical. The issues with ITO have been documented at the DOE SSL R & D and Manufacturing workshops for the last 5 years and the issue is being exacerbated by export controls from China (one of the major sources of elemental indium). Therefore, ITO is not sustainable because of the fluctuating costs and the United States (US) dependency on other nations such as China. Numerous alternatives to ITO/IZO are being evaluated such as Ag nanoparticles/nanowires, carbon nanotubes, graphene, and other metal oxides. Of these other metal oxides, doped zinc oxide has attracted a lot of attention over the last 10 years. The volume of zinc mined is a factor of 80,000 greater than indium and the US has significant volumes of zinc mined domestically, resulting in the ability for the US to be self-sufficient for this element that can be used in optoelectronic applications. The costs of elemental zinc is over 2 orders of magnitude less than indium, reflecting the relative abundance and availability of the elements. Arkema Inc. and an international primary glass manufacturing company, which is located in the United States, have developed doped zinc oxide technology for solar control windows. The genesis of this DOE SSL project was to determine if doped zinc oxide technology can be taken from the commodity based window market and translate the technology to OLED lighting. Thus, Arkema Inc. sought out experts, Philips Lighting, Pacific Northwest National Laboratories (PNNL) and National Renewable Research Laboratories (NREL), in OLED devices and brought them into the project. This project had a clear focus on economics and the work plan focused both on doped ZnO process and OLED device structure that would be consistent with the new TCO. The team successfully made 6 inch OLEDs with a serial construction. More process development is required to optimize commercial OLED structures. Feasibility was demonstrated on two different light extraction technologies: 1/4 lambda refractive index matching and high-low-high band pass filter. Process development was also completed on the key precursors for the TCO, which are ready for pilot-plant scale-up. Subsequently, Arkema has developed a cost of ownership model that is consistent with DOE SSL R & D Manufacturing targets as outlined in the DOE SSL R & D Manufacturing 2010 report. The overall outcome of this project was the demonstration that doped zinc oxide can be used for OLED devices without a drop-off in performance while gaining the economic and sustainable benefits of a more readily available TCO. The broad impact of this project, is the facilitation of OLED lighting market penetration into general illumination, resulting in significant energy savings, decreased greenhouse emissions, with no environmental impact issues such as mercury found in Fluorescent technology. The primary objective of this project was to develop a commercially viable process for 'Substrates' (Substrate/ undercoat/ TCO topcoat) to be used in production of OLED devices (lamps/luminaries/modules). This project focused on using Arkema's recently developed doped ZnO technology for the Fenestration industry and applying the technology to the OLED lighting industry. The secondary objective was the use of undercoat technology to improve light extraction from the OLED device. In optical fields and window applications, technology has been developed to mitigate reflection losses by selecting appropriate thicknesses and refractive indices of coatings applied either below or above the functional layer of interest. This technology has been proven and implemented in the fenestration industry for more than 15 years. Successful completion of this project would provide doped ZnO coated on inexpensive soda lime glass resulting in a significantly lower cost relative to the current ITO coated Flat Panel Display Glass substrates. Additional benefits will be a more consistent TCO that does not need an activation step with better optical performance. Clearly, this will serve to enhance penetration of OLED technologies into the lighting market.

OLED Displays and LightingJohn Wiley & Sons

The standard incandescent light bulb, which still works mainly as Thomas Edison invented it, converts more than 90% of the consumed electricity into heat. Given the availability of newer lighting technologies that convert a greater percentage of electricity into useful light, there is potential to decrease the amount of energy used for lighting in both commercial and residential applications. Although technologies such as compact fluorescent lamps (CFLs) have emerged in the past few decades and will help achieve the goal of increased energy efficiency, solid-state lighting (SSL) stands to play a large role in dramatically decreasing U.S. energy consumption for lighting. Since the publication of the 2013 National Research Council report Assessment of Advanced Solid-State Lighting, the penetration of SSL has increased dramatically, with a resulting savings in energy and costs that were foreshadowed by that study. What was not anticipated then is the dramatic dislocation and restructuring of the SSL marketplace, as cost reductions for light-emitting diode (LED) components reduced profitability for LED manufacturers. At the same time, there has been the emergence of new applications for SSL, which have the potential to create new markets and commercial opportunities for the SSL industry. Assessment of Solid-State Lighting, Phase Two discusses these aspects of changeâ€"highlighting the progress of commercialization and acceptance of SSL and reviewing the technical advances and challenges in achieving higher efficacy for LEDs and organic light-emitting diodes. This report will also discuss the recent trends in SSL manufacturing and opportunities for new applications and describe the role played by the Department of Energy (DOE) Lighting Program in the development of SSL.

Highly Efficient OLEDs

Flat Panel Display Manufacturing

Materials for Solid State Lighting and Displays

Enabling Thin, Lightweight, and Flexible Electronics

Advantages of Multi-primary Displays

This book covers all of the aspects necessary to the design and manufacturing of OLED displays. Topics include emission mechanism, material selection, device processing, manufacturing issues and countermeasures and display design basics. In addition, the book defines elements of OLED such as Thin Film Transistor (TFT) backplane design and processing details, including Low Temperature Poly Silicon (LTPS) process and circuit integration, and high yield method to manufacturer. Researchers and developers are aiming at making large OLED televisions and companies such as Samsung and Apple are rumored to be using OLED display for new screens. In addition to discussing the current composition of OLED, the book also covers the future for OLED technologies and displays. The Society for Information Display (SID) is an international society, which has the aim of encouraging the development of all aspects of the field of information display. Complementary to the aims of the society, the Wiley-SID series is intended to explain the latest developments in information display technology at a professional level. The broad scope of the series addresses all facets of information displays from technical aspects through systems and prototypes to standards and ergonomics

THE PERFECT GUIDE TO FLAT PANEL DISPLAYS FOR RESEARCHERS AND INDUSTRY PERSONNEL ALIKE Introduction to Flat Panel Displays, 2nd Edition is the leading introductory reference to state-of-the-art flat panel display technologies. The 2nd edition has been newly updated to include the latest developments for high pixel resolution support, high brightness, improved contrast settings, and low power consumption. The 2nd edition has also been updated to include the latest developments of head-mounted displays for virtual and augmented reality applications. Introduction to Flat Panel Displays introduces and updates both the fundamental physics and materials concepts underlying flat panel display technology and their application to smart phones, ultra-high definitions TVs, computers, and virtual and augmented reality systems. The book includes new information on quantum-dot enhanced LCDs, device configurations and performance, and nitrate-based LEDs. The authors also provide updates on technologies like: OLED materials, including phosphorescent, TTA, and TADF OLEDs White light OLED and light extraction OLED for mobile and TV Light and flexible OLED Reflective displays, including e-paper technology Low power consumption displays The perfect reference for graduate students and new entrants to the display industry, Introduction to Flat Panel Displays offers problem and homework sets at the end of each chapter to measure retention and learning.

Microdisplays are displays requiring optical magnification and OLEDs (Organic Light-Emitting Diode) are self-emitting displays where each pixel includes a LED made of organic material, in general composed of small-molecule organic material. This title reviews in detail how OLED microdisplays are made as well as how they are used. All aspects from theory to application will be addressed: basic principles, display design, display fabrication, operation and performances, present and future applications. The book will be useful to anyone interested in this rapidly developing field, such as students or researchers, industry professionals (engineers, project leaders) in the field of display development/fabrication and display end-users.

Explains the fundamentals and practical applications of flat and flexible OLEDs for displays and lighting Organic light-emitting diodes (OLEDs) have emerged as the leading technology for the new display and lighting market. OLEDs are solid-state devices composed of thin films of organic molecules that create light with the application of electricity. OLEDs can provide brighter, crisper displays on electronic devices and use less power than conventional light-emitting diodes (LEDs) or liquid crystal displays (LCDs) used today. This book covers both the fundamentals and practical applications of flat and flexible OLEDs. Key features: Covers all of the aspects necessary to the design and manufacturing of OLED displays and lighting. Explains the fundamental basic technologies and also related technologies which might contribute to the next innovation in the industry. Provides several indications for future innovation in the OLED industry. Includes coverage of OLED vacuum deposition type and solution type materials. The book is essential reading for early career engineers developing OLED devices and OLED related technologies in industrial companies, such as OLED device fabrication companies.

Technology and Applications

Fundamentals and Applications

Introduction to Flat Panel Displays

OLED Display

The OLED Handbook (2020 Edition)

Frontiers in Electrical Engineering is a book series dedicated to publishing current research in the field of electrical engineering and electronics. The vast amount of publications concerning these fields are summarized in each series volumes with a key focus on device structures and fabrication techniques that are pertinent to the practical production processes and electronic applications. This volume presents an introduction to the subject of Active-Matrix Organic Light-Emitting Display (AMOLED) technology. AMOLEDs are generally integrated into electronic applications and production processes, including understanding basic optical LED (OLED) working principles and the fabrication and characterization of electronic and semiconductor devices. Other applications of AMOLEDs include white OLEDs, light outcoupling, encapsulation, thin film transistor backplanes, driving schemes, and circuit and layout design technologies. This volume will be helpful to novice scientists and engineers working on the development of practical OLED display and OLED lighting technology. Researchers studying organic electronics and advanced undergraduate and graduate students and professionals involved in the OLED industry will also benefit from the information given in this monograph.

Solar Lighting

Essential ratings and characteristics of OLED display modules

Principles and Applications of Organic Light Emitting Diodes (OLEDs)

Fundamental and Novel Practical Technologies

Materials, Technologies and Applications