

# *Electronic Materials*

*From Silicon to Organics*



*Edited by L. S. Miller and J. B. Mullin*

# Electronic Materials From Silicon To Organics

**David Kirk**



## **Electronic Materials From Silicon To Organics:**

**Electronic Materials** L.S. Miller, J.B. Mullin, 2012-12-06 Electronic materials are a dominant factor in many areas of modern technology. The need to understand them is paramount; this book addresses that need. The main aim of this volume is to provide a broad unified view of electronic materials including key aspects of their science and technology and also in many cases their commercial implications. It was considered important that much of the contents of such an overview should be intelligible by a broad audience of graduates and industrial scientists and relevant to advanced undergraduate studies. It should also be up to date and even looking forward to the future. Although more extensive and written specifically as a text, the resulting book has much in common with a short course of the same name given at Coventry Polytechnic. The interpretation of the term electronic materials used in this volume is a very broad one in line with the initial aim. The principal restriction is that with one or two minor exceptions relating to aspects of device processing, for example the materials dealt with are all active materials. Materials such as simple insulators or simple conductors playing only a passive role are not singled out for consideration. Active materials might be defined as those involved in the processing of signals in a way that depends crucially on some specific property of those materials and the immediate question then concerns the types of signals that might be considered. *Electronic Materials: From Silicon To Organics* L.S. Miller, Electrical Characterization of Organic Electronic Materials and Devices Professor Peter Stallinga, 2009-10-08 Think like an electron. Organic electronic materials have many applications and potential in low cost electronics such as electronic barcodes and in light emitting devices due to their easily tailored properties. While the chemical aspects and characterization have been widely studied, characterization of the electrical properties has been neglected and classic textbook modeling has been applied. This is most striking in the analysis of thin film transistors (TFTs) using thick bulk transistor MOS FET descriptions. At first glance the TFTs appear to behave as regular MOS FETs. However, upon closer examination it is clear that TFTs are unique and merit their own model. Understanding and interpreting measurements of organic devices which are often seen as black box measurements is critical to developing better devices and this therefore has to be done with care. Electrical Characterization of Organic Electronic Materials and Devices Gives new insights into the electronic properties and measurement techniques for low mobility electronic devices. Characterizes the thin film transistor using its own model. Links the phenomena seen in different device structures and different measurement techniques. Presents clearly both how to perform electrical measurements of organic and low mobility materials and how to extract important information from these measurements. Provides a much needed theoretical foundation for organic electronics. Chemistry for Electronic Materials K.F. Jensen, T. Hirai, G. Wahl, Yves Pauleau, 1993-03-09 The chemical aspects of materials processing used for electronic applications e.g. Si III V compounds, superconductors, metallization materials are covered in this volume. Significant recent advances have occurred in the development of new volatile precursors for the fabrication of III V semiconductor and metal

Cu W films by OMCVD Some fundamentally new and wide ranging applications have been introduced in recent times Experimental and modeling studies regarding deposition kinetics operating conditions and transport as well as properties of films produced by PVD CVD and PECVD are discussed The thirty papers in this volume report on many other significant topics also Research workers involved in these aspects of materials technology may find here some new perspectives with which to augment their projects

**Organic Electronics Materials and Devices** Shuichiro Ogawa,2024-01-24 This book is an introductory text for graduate students researchers in industries and those who are just beginning to work on organic electronics materials devices and their applications The book includes mainly fundamental principles and theories for understanding organic electronics materials and devices but also provides information about state of the art technologies applications and future prospects These topics encompass physics for organic transistors structure control technologies of polymer semiconductors nanomaterials electronics organic solar cells organic electroluminescence and dynamics for excitation among others In this second edition the topics that have had particular progress in the field of organic electronics over the past seven years were added For example Thermally Activated Delayed Fluorescence TADF technology for organic LED the development of perovskite materials light emitting materials using nanomaterials and the development of skin sensors and wearable embedded devices The recent scientific understanding of organic electronics is also introduced This book will help readers to be able to contribute to society with the technologies and science of organic electronics materials in the future

**Silicon Polymers** Aziz M. Muzafarov,2010-09-22 Modern Synthetic and Application Aspects of Polysilanes An Underestimated Class of Materials by A Feigl A Bockholt J Weis and B Rieger Conjugated Organosilicon Materials for Organic Electronics and Photonics by Sergei A Ponomarenko and Stephan Kirchmeyer Polycarbosilanes Based on Silicon Carbon Cyclic Monomers by E Sh Finkelshtein N V Ushakov and M L Gringolts New Synthetic Strategies for Structured Silicones Using B C<sub>6</sub>F<sub>5</sub> 3 by Michael A Brook John B Grande and Fran ois Ganachaud Polyhedral Oligomeric Silsesquioxanes with Controlled Structure Formation and Application in New Si Based Polymer Systems by Yusuke Kawakami Yuriko Kakihana Akio Miyazato Seiji Tateyama and Md Asadul Hoque

*Organic Electronic Materials* R. Farchioni,G. Grosso,2013-11-21 Studies on the electronic properties of conjugated polymers and low molecular weight organic solids have been of increasing interest in recent years This book is organized into two parts dedicated to these two classes of materials For each part a general introductory review provides background knowledge of the language and of the main points required for understanding the book s contents The reviews that follow provide a more complete understanding of the underlying physics of the materials through discussion of the interconnected topics Theoretical concepts models and methods are overviewed this is used to support the explanation of the physical and chemical properties of these materials The presentation of selected aspects of experimental research greatly contributes to the basic understanding of organic electronic materials

*Advanced Organics for Electronic Substrates and Packages* Andrew E Fletcher,2013-10-22 Advanced

Organics for Electronic Substrates and Packages provides information on packaging which is one of the most technologically intensive activities in the electronics industry The electronics packaging community has realized that while semiconductor devices continue to be improved upon for performance cost and reliability it is the interconnection or packaging of these devices that will limit the performance of the systems Technology must develop packaging for transistor chips with high levels of performance and integration providing cooling power and interconnection and yet preserve the performance of the semiconductors with minimum package delay to the system Trends in each of the major packaging technologies include chip level connection providing the required connections between the chip and the semiconductor package The power distribution to the chip and heat removal from the chip first level packages providing all the necessary wiring interconnections and power distribution first to second level interconnections and second level packages providing all the necessary wiring connections power distribution and power supply connection are included as well This book is a useful and informative reference to students or individuals studying or conducting research within the field of electronic engineering

**Handbook of Organic Materials for Electronic and Photonic Devices** Oksana Ostroverkhova, 2018-11-30 Handbook of Organic Materials for Electronic and Photonic Devices Second Edition provides an overview of the materials mechanisms characterization techniques structure property relationships and most promising applications of organic materials This new release includes new content on emerging organic materials expanded content on the basic physics behind electronic properties and new chapters on organic photonics As advances in organic materials design fabrication and processing that enabled charge unprecedented carrier mobilities and power conversion efficiencies have made dramatic advances since the first edition this latest release presents a necessary understanding of the underlying physics that enabled novel material design and improved organic device design Provides a comprehensive overview of the materials mechanisms characterization techniques and structure property relationships of organic electronic and photonic materials Reviews key applications including organic solar cells light emitting diodes electrochemical cells sensors transistors bioelectronics and memory devices New content to reflect latest advances in our understanding of underlying physics to enable material design and device fabrication

Organic and Molecular Electronics Michael C. Petty, 2019-01-04 An introduction to the interdisciplinary subject of molecular electronics revised and updated The revised second edition of Organic and Molecular Electronics offers a guide to the fabrication and application of a wide range of electronic devices based around organic materials and low cost technologies Since the publication of the first edition organic electronics has greatly progressed as evidenced by the myriad companies that have been established to explore the new possibilities The text contains an introduction into the physics and chemistry of organic materials and includes a discussion of the means to process the materials into a form in most cases a thin film where they can be exploited in electronic and optoelectronic devices The text covers the areas of application and potential application that range from chemical and biochemical sensors to plastic light emitting displays The updated second

edition reflects the recent progress in both organic and molecular electronics and Offers an accessible resource for a wide range of readers Contains a comprehensive text that covers topics including electrical conductivity optical phenomena electroactive organic compounds tools for molecular electronics and much more Includes illustrative examples based on the most recent research Presents problems at the end of each chapter to help reinforce key points Written mainly for engineering students Organic and Molecular Electronics From Principles to Practice provides an updated introduction to the interdisciplinary subjects of organic electronics and molecular electronics with detailed examples of applications

*Nanotechnology for Electronic Materials and Devices* Anatoli Korkin, Evgeni Gusev, Jan K. Labanowski, Serge Luryi, 2010-05-07 The high level of attention and interest of the global community to NANO science and technology to a large extent is linked to the GIGAntic challenges for the continuing growth of information technology which sparked an unprecedented level of interdisciplinary and international cooperation among industrial and academic researchers companies IT market rivals and countries including former political and military rivals Microelectronics technologies have reached a new stage in their development The latest miniaturization of electronic devices is approaching atomic dimensions interconnect bottlenecks are limiting circuit speeds new materials are being introduced into microelectronics manufacture at an unprecedented rate and alternative technologies to mainstream complementary metal oxide semiconductors CMOSs are being considered The very dynamic stage of science and technology related to the advanced and future electronics and photonics creates a growing gap between the large number of rapid publications and nanotechnology highlights in media on one side and fundamental understanding of underlying phenomena and an adequate evaluation of scientific discoveries and technological innovations on the other side Writing a tutorial book on fundamentals of science and technology for electronics at this time is almost the same level of challenge as writing a history book during a revolution **Sustainable Strategies**

**in Organic Electronics** Assunta Marrocchi, 2022-02-02 Sustainable Strategies in Organic Electronics reviews green materials and devices sustainable processes in electronics and the reuse recycling and degradation of devices Topics addressed include large scale synthesis and fabrication of safe device materials processes that neither use toxic reagents solvents or produce toxic by products Emerging opportunities such as new synthetic approaches for enabling the commercialization of pi conjugated polymer based devices are explored along with new efforts towards incorporating materials from renewable resources for a low carbon footprint Finally the book discusses the latest advances towards device biodegradability and recycling It is suitable for materials scientists and engineers chemists physicists in academia and industry Discusses emerging opportunities for green materials synthesis and fabrication of organic electronics Reviews the challenges of integration of sustainable strategies in large scale manufacturing of organic electronics Provides an overview of green materials and solvents that can be used as alternatives to toxic materials for organic electronics applications

*Handbook of Flexible and Stretchable Electronics* Muhammad M. Hussain, Nazek El-Atab, 2019-11-11 Flexibility and

stretchability of electronics are crucial for next generation electronic devices that involve skin contact sensing and therapeutic actuation This handbook provides a complete entrance to the field from solid state physics to materials chemistry processing devices performance and reliability testing and integrated systems development This work shows how microelectronics signal processing and wireless communications in the same circuitry are impacting electronics healthcare and energy applications Key Features Covers the fundamentals to device applications including solid state and mechanics chemistry materials science characterization techniques and fabrication Offers a comprehensive base of knowledge for moving forward in this field from foundational research to technology development Focuses on processing characterization and circuits and systems integration for device applications Addresses the basic physical properties and mechanics as well as the nuts and bolts of reliability and performance analysis Discusses various technology applications from printed electronics to logic and memory devices sensors actuators displays and energy storage and harvesting This handbook will serve as the one stop knowledge base for readership who are interested in flexible and stretchable electronics **Short-Channel**

**Organic Thin-Film Transistors** Tarek Zaki, 2015-05-27 This work takes advantage of high resolution silicon stencil masks to build air stable complementary OTFTs using a low temperature fabrication process Plastic electronics based on organic thin film transistors OTFTs pave the way for cheap flexible and large area products Over the past few years OTFTs have undergone remarkable advances in terms of reliability performance and scale of integration Many factors contribute to the allure of this technology the masks exhibit excellent stiffness and stability thus allowing OTFTs with submicrometer channel lengths and superb device uniformity to be patterned Furthermore the OTFTs employ an ultra thin gate dielectric that provides a sufficiently high capacitance to enable the transistors to operate at voltages as low as 3 V The critical challenges in this development are the subtle mechanisms that govern the properties of aggressively scaled OTFTs These mechanisms dictated by device physics are well described and implemented into circuit design tools to ensure adequate simulation accuracy *World Scientific Handbook Of Organic Optoelectronic Devices (Volumes 3 & 4)*, 2022-04-08 Organic opto

electronic materials have received considerable attention due to their applications in perovskite and flexible electronics OPVs and OLEDs and many others Reflecting the rapid growth in research and development of organic opto electronic materials over the last few decades World Scientific Handbook of Organic Optoelectronic Devices provides a comprehensive coverage of the state of the art in an accessible format It presents the most widely recognized fundamentals principles and mechanisms along with representative examples key experimental data and over 200 illustrative figures [Introduction to Flexible Electronics](#) Aftab M. Hussain, 2021-12-27 The field of flexible electronics has grown rapidly over the last two decades with diverse applications including wearable gadgets and medical equipment This textbook comprehensively covers the fundamental aspects of flexible electronics along with materials and processing techniques It discusses topics including flexural rigidity flexible PCBs organic semiconductors nanostructured materials material reliability electronic reliability

crystalline and polymer materials semiconductor processing and flexible silicon in depth The text covers advantages disadvantages and applications of processes such as sol gel processing and ink jet printing Pedagogical features such as solved problems and unsolved exercises are interspersed throughout the text for better understanding FEATURES Covers major areas such as materials physics processes and applications of flexible electronics Contains homework problems for readers to understand concepts in an easy manner Discusses in detail various types of materials such as flexible silicon metal oxides and organic semiconductors Explains the application of flexible electronics in displays solar cells and batteries Includes a section on stretchable electronics This textbook is primarily written for senior undergraduate and graduate students in electrical engineering electronics materials science chemistry and communication engineering for a course on flexible electronics Teaching resources are available including a solutions manual for instructors

**Green Materials for Electronics** Mihai Irimia-Vladu, Eric D. Glowacki, Niyazi S. Sariciftci, Siegfried Bauer, 2017-09-12 Combining the materials science technological and device aspects of organic bioelectronics based on green materials this is the first overview of the emerging concepts involving fabrication techniques for sustainable electronics with low energy and material consumption With contributions from top notch editors and authors in one focus the book covers a collection of natural materials suited for electronics applications such as paper silk melanin DNA and nucleobases resins gums saccharides cellulose gelatine and peptides In another thrust the book focuses on device fabrication based on these materials including processing aspects and applications such as sensors signal transducers transient implantable and digestible electronics With its interdisciplinary approach this text will appeal to the chemistry physics materials science and engineering communities *Wspc Reference*

*On Organic Electronics, The: Organic Semiconductors (In 2 Volumes)* Seth R Marder, Jean-luc Bredas, 2016-06-24 This 2 volume set provides the reader with a basic understanding of the foundational concepts pertaining to the design synthesis and applications of conjugated organic materials used as organic semiconductors in areas including organic photovoltaic devices light emitting diodes field effect transistors spintronics actuation bioelectronics thermoelectrics and nonlinear optics While there are many monographs in these various areas the emphasis here is both on the fundamental chemistry and physics concepts underlying the field of organic semiconductors and on how these concepts drive a broad range of applications This makes the volumes ideal introductory textbooks in the subject They will thus offer great value to both junior and senior scientists working in areas ranging from organic chemistry to condensed matter physics and materials science and engineering Number of Illustrations and Tables 168 b w illus 242 colour illus 13 tables Organic Electronics Hagen Klauk, 2006-12-13 Edited and written by the leading researchers and engineers from such companies as Philips 3M Xerox Infineon PlasticLogic Eastman Kodak Dupont AIXTRON and Hueck Folien this book presents unrivalled and undiluted expertise from those who know best how to assess the risks opportunities and where this technology is really heading As such this practical approach complements the more scientific and fundamentals oriented literature on the market by



providing readers with a first hand insight into industrial activities to commercialize organic electronics Following an introduction to the topic including the history motivation benefits and potentials it reviews recent advances and covers all three important facets of organic electronics the chemical compounds and materials manufacturing techniques and the resulting devices together with their current applications

**Printed Electronics** Zheng Cui, 2016-09-26 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

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### **Electronic Materials From Silicon To Organics Introduction**

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web allow the gaseous phase thermodynamics to be curve fitted to 300k about 142k lower than the normal boiling point 542k 2 of kerosene nevertheless in actual calculations involving liquid kerosene fuel the heat capacity and latent heat of vaporization of

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