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Expand/Collapse Synopsis Terahertz (THz) radiation, which is electromagnetic radiation in a frequency int- val from 0.3 to 10 THz (1 mm–30 ?m wavelength), is the next frontier in science and technology. This band occupies a large portion of the electromagnetic sp- trum between the infrared and microwave bands.

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Terahertz (THz) radiation, which is electromagnetic radiation in a frequency int- val from 0.3 to 10 THz (1 mm–30 ?m wavelength), is the next frontier in science and technology. This band occupies a large portion of the electromagnetic sp- trum between the infrared and microwave bands. Basic research, new initiatives, and developments in advanced sensing and imaging technology with regard to the THz band remain unexplored compared to the relatively well-developed science and technology in the microwave and optical frequencies. Historically, THz technologies were used mainly within the astronomy c- munity for studying the background of cosmic far-infrared radiation, and by the laser-fusion community for the diagnostics of plasmas. Since the ?rst demonstration of THz wave time-domain spectroscopy in the late 1980s, there has been a series of signi?cant advances (particularly in recent years) as more intense THz sources and higher sensitivity detectors provide new opportunities for understanding the basic science in the THz frequency range.

A concise, accessible guide explaining the essential ideas underlying photonics and how they relate to photonic devices and systems.

This volume presents an up-to-date review of modern materials and concepts, issues, and recent advances in analytical and physical chemistry. Distinguished scientists and engineers from key institutions worldwide have contributed chapters that provide a deep analysis of their particular subjects. The chapters discuss the composition and properties of complex materials as well as mixtures, processes, and the need for new and improved analytical technology.

The terahertz regime of the electromagnetic spectrum was largely unexplored due to the lack of technology needed to generate and detect the radiation. However, in the last couple of decades, there has been a dramatic increase in tools needed to harness the radiation. This remarkable progress made in the development of terahertz sources, components, and detectors has resulted in an ever-increasing inquisitiveness of the applications of terahertz technology in a wide range of fields including medicine, pharmaceuticals, security, sensing, and quality assurance. This book, *Terahertz Spectroscopy - A Cutting Edge Technology*, presents an overview of the recent advances in terahertz technology and their application in a vast array of fields. The scientists and students are encouraged to read and share the content of this volume. The book also provides a good starting point for researchers who are new to the terahertz regime. The various chapters of the book have been written by renowned scientists in different parts of the world who are at the forefront of terahertz research fields. It is our (InTech publisher, editor, and authors) hope that this book will enhance knowledge and stimulate more interest and future research in terahertz technology.

This book highlights recent advances and applications in terahertz (THz) technology, addressing advanced topics such as THz biomedical imaging, pattern recognition and tomographic reconstruction for THz biomedical imaging by machine learning and artificial intelligence, THz imaging radars for autonomous vehicle applications, and THz imaging systems for security and surveillance. It also discusses theoretical, experimental, established and validated empirical work on these topics.

This introductory, yet in-depth, book explains the physical principles of electronic imaging and sensing and provides the reader with the information necessary to understand the design, operation, and practical applications of contemporary electronic imaging and sensing systems. The text has strong practical focus and contains examples of biomedical applications of optical electronic imaging and sensing. Each chapter draws upon the authors' extensive research, teaching, and industrial experience and provides a useful resource for undergraduate and graduate students, as well as a convenient reference for scientists and engineers working in the field of electronic imaging and sensing.

IR and THz technologies are widely used in security screening and surveillance, astronomy, spectroscopy, biomedicine, food and package inspection, detection of concealed weapons, vision through camouflage, etc. There are increasing demands for the fast transmission of large amounts of data. THz radiation penetrates dielectric materials like plastics, ceramics or cardboard allowing contact-free testing. Medical imaging technologies can provide guidance for surgeons in delimiting the margins of tumors, help clinicians to visualize diseased areas, etc. Keywords: THz and IR Detectors, THz and IR Sources, Superconducting Photon Detectors, Superconducting THz Detectors, Graphene-based Detectors, THz Sensors with Metamaterials, Photoconductive Antenna Detectors, Imaging, Communication, Spectroscopy, Sensing, Security Screening, Surveillance, Astronomy, Biomedicine, Food Inspection, Package Inspection, Concealed Weapons Detection, Transmission of Large Amounts of Data, Non-destructive Testing, Contact-free Testing, Medical Imaging Technologies.

This book brings together 11 invited papers from the Workshop on Frontiers in Electronics (WOFE) 2013 that took place at San Juan, Puerto Rico, in December 2013. These articles present the ground-breaking works by world leading experts from CMOS and SOI, to wide-bandgap semiconductor technology, terahertz technology, and bioelectronics. WOFE is a bi-annual gathering of leading researchers from around the world, across multiple disciplines, to share their results and discuss key issues in the future development of microelectronics, photonics, and nanoelectronics. The focus of this volume includes topics ranging from advanced transistors: TFT, FinFET, TFET, HEMT to Nitride devices, as well as emerging technologies, devices and materials. This book will be a useful reference for scientists, engineers, researchers, and inventors looking for the future research and development direction of microelectronics, and the trends and technology underpinning these developments.

Terahertz Biomedical and Healthcare Technologies: Materials to Devices reviews emerging advances in terahertz biomedical and healthcare technologies, including advances in fundamental materials science research, device design and fabrication, applications, and challenges and opportunities for improved performance. In addition, the improvement of materials, optical elements, and measuring techniques are also explored. Other sections cover the design and development of wide bandgap semiconductors for terahertz device applications, including their physics, device modeling, characterization and fabrication concepts. Finally, the book touches on potential defense, medical imaging, internet of things, and the machine learning applications of terahertz technologies. Reviews the latest advances in the fundamental and applied research of terahertz technologies, covering key topics in materials science, biomedical engineering and healthcare informatics. Includes applications of terahertz technologies in medical imaging, diagnosis and treatment. Provides readers with an understanding of the machine learning, pattern recognition, and data analytics research utilized to enhance the effectiveness of terahertz technologies.

A comprehensive device model considering both spatial distributions of the terahertz field and the field-effect self-mixing factor has been constructed for the first time in the thesis. The author has found that it is the strongly localized terahertz field induced in a small fraction of the gated electron channel that plays an important role in the high responsivity. An AlGaIn/GaN-based high-electron-mobility transistor with a 2-micron-sized gate and integrated dipole antennas has been developed and can offer a noise-equivalent power as low as 40 pW/Hz^{1/2} at 900 GHz. By further reducing the gate length down to 0.2 micron, a noise-equivalent power of 6 pW/Hz^{1/2} has been achieved. This thesis provides detailed experimental techniques and device simulation for revealing the self-mixing mechanism including a scanning probe technique for evaluating the effectiveness of terahertz antennas. As such, the thesis could be served as a valuable introduction towards further development of high-sensitivity field-effect terahertz detectors for practical applications.

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