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Random lasers are the simplest sources of stimulated emission without cavity, with the feedback provided by scattering in a gain medium. First proposed in the late 1960s, random lasers have grown to a large research field. This book reviews the history and the state of the art of random lasers, provides an outline of the basic models describing their behavior, and describes the recent advances in the field. The major focus of the book is on solid-state random lasers. However, it also briefly describes random lasers based on liquid dyes with scatterers. The chapters of the book are almost independent of each other. So, the scientists or engineers interested in any particular aspect of random lasers can read directly the relevant section. Researchers entering the field of random lasers will find in the book an overview of the field of study. Scientists working in the field can use the book as a reference source.

This book gives a contemporary overview of the technologies of single-frequency fiber lasers. The development of single-frequency fiber lasers is one of the most significant achievements in the field of laser photonics over the past two decades. Owing to the crucial demands of a laser sources with highly stable single-frequency operation, narrow linewidth, low noise, scalable to high output power, compact and robustness structure, fiber lasers have been intensively studied since its introduction to the single-frequency laser community and they still continuously proceed to trigger the emergence of new technologies and applications. This book systematically demonstrates the single-frequency fiber laser technologies from fundamental principles to state-of-the-art progress. Details of selected typical applications of single-frequency fiber lasers are also given and discussed. The reader will acquire a good knowledge of the current situation within this important field.

Optical Bistability: Controlling Light with Light focuses on optical bistability in nonlinear optical systems. Emphasis is on passive (non-laser) systems that exhibit reversible bistability with input intensity as the hysteresis variable, along with the physics and the potential applications of such systems for nonlinear optical signal processing. This book consists of seven chapters and begins with a historical overview of optical bistability in lasers and passive systems. The next chapter describes steady-state theories of optical bistability, including the Bonifacio-Lugiato model, as well as the boundary conditions of an optical cavity and the coupled Maxwell-Bloch equations. Both intrinsic and hybrid experiments are then described, along with light-by-light control, pulse reshaping, and external switching. The transient phenomena that arise either from instabilities in the bistable systems themselves or from fluctuations in the number of nonlinear atoms or in the number of intracavity photons are also considered. The final chapter examines the characteristics and fundamental limitations of an ideal device, the prospect of improving devices by identifying giant nonlinearities, and the utilization of the full power of optics by parallel processing. This monograph is intended for new entrants and active workers in the field of optical bistability.

Proceedings of SPIE present the original research papers presented at SPIE conferences and other high-quality conferences in the broad-ranging fields of optics and photonics. These books provide prompt access to the latest innovations in research and technology in their respective fields. Proceedings of SPIE are among the most cited references in patent literature.

Describes all aspects of the physics of transition metal compounds, providing a comprehensive overview of this diverse class of solids. Set within a modern conceptual framework, this is an invaluable, up-to-date resource for graduate students, researchers and industrial practitioners in solid-state physics and chemistry, materials science, and inorganic chemistry.

This book is addressed at upper-division undergraduate and graduate students involved in research in Atomic, Molecular, and Optical Physics. It will also be useful to researchers practicing in this field. It gives an intuitive, yet sufficiently detailed and rigorous introduction to light-atom interactions with a particular emphasis on the symmetry aspects of the interaction, especially those associated with the angular momentum of atoms and light. The book comeswith a software package for a variety of atomic-physics calculations and further interactive examples that is freely downloadable from the book's web page, as well as additional materials (such aspower-point presentations) available to Instructors who adopt the text for their courses.

Research and developments in neuroprostheses are providing scientists with the potential to greatly improve the lives of individuals who have lost some function. Neuroprostheses can help restore or substitute motor and sensory functions which may have been damaged as a result of injury or disease. However, these minute implantable sensors also provide scientists with challenges. This important new book provides readers with a comprehensive review of neuroprostheses. Chapters in part one are concerned with the fundamentals of these devices. Part two looks at neuroprostheses for restoring sensory function whilst part three addresses neuroprostheses for restoring motor function. The final set of chapters discusses significant considerations concerning these sensors. Systematic and comprehensive coverage of neuroprostheses Covers the fundamentals of neuroprostheses, their application in restoring sensory and motor function and an analysis of the future trends Keen focus on industry needs in the field of biomaterials

This book serves as a comprehensive, up-to-date reference about this cutting-edge laser technology and its many new and interesting developments. Various aspects and trends of Raman fiber lasers are described in detail by experts in their fields. Raman fiber lasers have progressed quickly in the past decade, and have emerged as a versatile laser technology for generating high power light sources covering a spectral range from visible to mid-infrared. The technology is already being applied in the fields of telecommunication, astronomy, cold atom physics, laser spectroscopy, environmental sensing, and laser medicine. This book covers various topics relating to Raman fiber laser research, including power scaling, cladding and diode pumping, cascade Raman shifting, single frequency operation and power amplification, mid-infrared laser generation, specialty optical fibers, and random distributed feedback Raman fiber lasers. The book will appeal to scientists, students, and technicians seeking to understand the recent developments and future trends of this promising and multifaceted technology.

The book explores the current state of laser dynamics and provides reference data and basic experimental facts for old- and new-generation lasers. The most frequently used mathematical models are presented. The author discusses the reasons for the spontaneous occurrence of pulsation of the intensity of radiation of solid-state lasers and the influence of the non-stationary nature of laser elements on lasing characteristics. Special emphasis is placed on the problems of the low-frequency dynamics of multimode lasers. This book is aimed at experts in the fields of quantum electronics and laser physics.

Electric dipole moments (EDMs) have interested physicists since 1950, when it was first suggested that there was no experimental evidence that nuclear forces are symmetric under parity (P) transformation. This question was regarded as speculative because the existence of an EDM, in addition to P violation, requires a violation of time-reversal (T) symmetry. In 1964 it was discovered that the invariance under CP transformation, which combines charge conjugation (C) with parity, is violated in K-meson decays. This provided a new incentive for EDM searches. Since the combined operations of CPT are expected to leave a system invariant, breakdown of CP invariance should be accompanied by a violation of time-reversal symmetry. Thus there is a reason to expect that EDMs should exist at some level. The original neutron EDM experiments were later supplemented with checks of T invariance in atoms and molecules. These investigations are pursued

now by many groups. Over the years, the upper limit on the neutron EDM has been improved by seven orders of magnitude, and the upper limit on the electron EDM obtained in atomic experiments is even more strict.

Optical Spectra of Transparent Rare Earth Compounds investigates the optical spectra of transparent rare earth (RE) compounds such as europium chalcogenides. Emphasis is placed on the underlying physics in selected examples, and theoretical results are usually presented without proof in a form that allows their application to the interpretation of experimental data. This book is comprised of 11 chapters and begins with an overview of the spectra of RE ions in ionic crystals, paying particular attention to the sharpness of many lines in the absorption and emission spectra. How these very narrow lines arise, what interactions determine their energy, and how they can be used to investigate particular properties of the solid state are explained in detail. Subsequent chapters explore the energy structure of RE free ions in solids; trivalent RE ions in a static crystal field and in a phonon field; magnetic interactions and hyperfine interactions; and Jahn-Teller systems. The absorption spectra of europium chalcogenides are also considered, along with REs in glasses and RE lasers. This monograph is written primarily for solid state physicists and those who need an overall view of the basic features of rare earth spectra in transparent solids, such as new workers.

High-technology and environmental applications of the rare-earth elements (REE) have grown dramatically in diversity and importance over the past four decades. This book provides a scientific understanding of rare earth properties and uses, present and future. It also points the way to efficient recycle of the rare earths in end-of-use products and efficient use of rare earths in new products. Scientists and students will appreciate the book's approach to the availability, structure and properties of rare earths and how they have led to myriad critical uses, present and future. Experts should buy this book to get an integrated picture of production and use (present and future) of rare earths and the science behind this picture. This book will prove valuable to.non-scientists as well in order to get an integrated picture of production and use of rare earths in the 21st Century, and the science behind this picture. Defines the chemical, physical and structural properties of rare earths. Gives the reader a basic understanding of what rare earths can do for us. Describes uses of each rare earth with chemical, physics, and structural explanations for the properties that underlie those uses. Allows the reader to understand how rare earths behave and why they are used in present applications and will be used in future applications. Explains to the reader where and how rare earths are found and produced and how they are best recycled to minimize environmental impact and energy and water consumption.

It is a pleasure to contribute the foreword to Introduction to Cell and Tissue Culture: The ory and Techniques by Mather and Roberts. Despite the occasional appearance of thought ful works devoted to elementary or advanced cell culture methodology, a place remains for a comprehensive and definitive volume that can be used to advantage by both the novice and the expert in the field. In this book, Mather and Roberts present the relevant method ology within a conceptual framework of cell biology, genetics, nutrition, endocrinology, and physiology that renders technical cell culture information in a comprehensive, logical for mat. This allows topics to be presented with an emphasis on troubleshooting problems from a basis of understanding the underlying theory. The material is presented in a way that is adaptable to student use in formal courses; it also should be functional when used on a daily basis by professional cell culturists in a- demia and industry. The volume includes references to relevant Internet sites and other use ful sources of information. In addition to the fundamentals, attention is also given to mod ern applications and approaches to cell culture derivation, medium formulation, culture scale-up, and biotechnology, presented by scientists who are pioneers in these areas. With this volume, it should be possible to establish and maintain a cell culture laboratory devot ed to any of the many disciplines to which cell culture methodology is applicable.

Boron Oxide plays a key role in numerous glasses of high technological importance, yet its role in glass structure is far from clear. Indeed, in recent years there have been serious chal lenges to previous structure concepts for both crystalline and glassy borates. These challenges were sufficient to warrant a re examination of the structure of borate glasses using the most pow erful tools currently available. To provide a suitable forum for this undertaking, a four-day conference on "Boron in Glass and Glass Ceramics" was convened at Alfred University, June 3-8, 1977 to review the best scientific thinking on structure and to debate conflicting views and discuss properties and applications of borate glasses. This conference was also the first in a New University series on Glass Science to be rotated among Alfred University, The Pensyl vania State University, Rensselaer Polytechnic Institute, and the University of Missouri-Rolla. The present volume represents the proceedings of the first conference in this series. The volume begins with a review of the remarkable contribution of Jan Krogh-Moe to the understanding of the structure of Borate glasses. This review, authored by Professor N. J. Kreidl, concludes by dedicating the proceedings of this conference as a Krogh-Moe Fest schrift. The volume continues with a historical review by D. L. Griscom, originally prepared for circulation to the contributors prior to the conference. An Epilogue to the opening chapter brings the survey up-to-date in light of the conference papers.
This book has once again been updated to keep pace with recent developments and to maintain Koechner's position as "the bible" of the field. Written from an industrial perspective, it provides a detailed discussion of, and data for, solid-state lasers, their characteristics, design and construction.
An important guide to the major techniques for generating coherent light in the mid-infrared region of the spectrum Laser-based Mid-infrared Sources and Applications gives a comprehensive overview of the existing methods for generating coherent light in the important yet difficult-to-reach mid-infrared region of the spectrum (2–20 ?m) and their applications. The book describes major approaches for mid-infrared light generation including ion-doped solid-state lasers, fiber lasers, semiconductor lasers, and laser sources based on nonlinear optical frequency conversion, and reviews a range of applications: spectral recognition of molecules and trace gas sensing, biomedical and military applications, high-field physics and attoscience, and others. Every chapter starts with the fundamentals for a given technique that enables self-directed study, while extensive references help conduct deeper research. Laser-based Mid-infrared Sources and Applications provides up-to-date information on the state-of the art mid-infrared sources, discusses in detail the advancements made over the last two decades such as microresonators and interband cascade lasers, and explores novel approaches that are currently subjects of intense research such as supercontinuum and frequency combs generation. This important book: • Explains the fundamental principles and major techniques for coherent mid-infrared light generation • Discusses recent advancements and current cutting-edge research in the field • Highlights important biomedical, environmental, and military applications Written for researchers, academics, students, and engineers from different disciplines, the book helps navigate the rapidly expanding field of mid-infrared laser-based technologies.
This book describes the rapidly expanding field of two-dimensional (2D) transition metal carbides and nitrides (MXenes). It covers fundamental knowledge on synthesis, structure, and properties of these new materials, and a description of their processing, scale-up and emerging applications. The ways in which the quickly expanding family of MXenes can outperform other novel nanomaterials in a variety of applications, spanning from energy storage and conversion to electronics; from water science to transportation; and in defense and medical applications, are discussed in detail.
This book provides a comprehensive overview of the chalcogenide glass science and various applications based on the glasses. It starts with a review on the glass-forming ability of various systems, followed by a discussion on the structural and physical properties of various

chalcolgenide glasses and their application in integrated optics. The chapters have been contributed by prominent experts from all over the world, and therefore, the book presents the recent research advances in the area. This book will appeal to anyone who is involved in glass science and technology and glass application.

Science is not a mere collection of facts. It is the correlation of facts, the interpretative synthesis of the available knowledge and its application that excite the imagination of a scientist. Even in these days of modern technology, the need for quick and accurate dissemination of new information and current concepts still exists. Conferences and Symposia offer one direct method of communication. The Summer Schools are another approach. The success of a Summer School is mainly due to that human factor and under standing that goes with it and allows for extensive and often time-unrestricted discussions. During the course of the past 20 years, one of the most in tensively studied groups of elements in the Periodic Table is the Lanthanides. In this period, we have increased our knowledge on these once exotic elements, which were once considered to be a part of a lean and hungry industry, many-fold due to the involve ment of scientists from various disciplines. The purpose of our Summer School was to bring a group of ex perts and participants together for the exchange of ideas and in formation in an informal setting and to promote interdisciplinary interactions. Out of many conceivable topics, we selected the following five as the main basis to broaden our knowledge and understanding I) Systematics 2) Structure 3) Electronic and Magnetic Proper ties 4) Spectroscopic Properties and 5) Lanthanide Geochemistry.

Integrated optoelectronics is becoming ever more important to communications, computer, and consumer industries. It is the enabling technology in a variety of systems, ranging from low-cost, robust optical componentsin consumer electronics to high-performance broadband information networks capable of supporting video and multimedia conferencing. The requirements for producing low-cost, highly reliable components for deployment in these new systems have created a technology challenge. Integrated optoelectronics promises to meet the performance and cost objectives of these applications by integrating both optical and electronic components in a highly functional chip. This book provides an overview of this exciting newtechnology. Integrated Optoelectronics brings together a group of acknowledged experts from both universities and industry around the world to focus on a common theme of integration. These experts have reported not only on the state-of-the-art, but also on the physics and design experience that goes into implementing integrated chips and modules. This book is a cohesive series of articles that includes a discussion of the intimate trade-offs between materials, processes, devices, functional blocks, packaging,and systems requirements in a truly integrated technology. This integration encompasses electrical, optoelectronic, and optical devices onto monolithic or hybrid chips, and into multichip modules. This volume surveys state-of-the-art research activities in integrated optoelectronics and gathers most of the important references into a single place. It outlines the major issues involved in integrating both optical and electronic components, provides an overview of design and fabrication concepts, and discusses the issues involved in bringing these new chips to the marketplace. This exciting new book: Provides a broad overview of the optoelectronic field, including materials processing, devices, and systems applications Features authors who are acknowledged research experts in this field, from both industry and universities around the world Includes new information on device fabrication, including the latest epitaxial growth and lift-off techniques to permit the mixing of dissimilar materials onto single chips Covers planar processed laser fabrication leading to wafer level automated testing Discusses optimization of devices for integration, including a detailed treatment of the vertical emitting laser and theoretical and experimental coverage of optimization of photodetectors for integration into receiver chips Describes design approaches for multifunctional chips, including photonic circuits for all-optical networks and the design of integrated optoelectronic chips with lasers, photodiodes, and electronic ICs Covers the

infrastructure needed to support an integrated technology, including automated design systems which treat both optical and electrical circuits, and multichip packaging approaches for both optical and IC chips

Luminescence Thermometry: Methods, Materials, and Applications presents the state-of-the art applications of luminescence thermometry, giving a detailed explanation of luminescence spectroscopic schemes for the read-out of temperature, while also describing the diverse materials that are capable of sensing temperature via luminescence. Chapters cover the fundamentals of temperature, traditional thermometers and their figures of merit, a concise description of optical thermometry methods, luminescence and instrumentation, and an explanation of the ways in which increases in temperature quench luminescence. Additional sections focus on materials utilized for luminescence thermometry and the broad range of applications for luminescence thermometry, including temperature measurement at the nanoscale and the application of multifunctional luminescent materials. Provides an overview of luminescence thermometry applications, including high-temperature, biomedical, nanoscale and multifunctional Delves into luminescence thermometry by materials group, including Rare-earth and transition Metal Ion Doped, Semiconductors, Quantum Dots and Organic materials Gives a concise introduction of the latest methods of temperature measurement, including luminescence spectroscopic schemes and methods of analysis

Traces the quest to use nanostructured media for novel and improved optoelectronic devices. Leading experts - among them Nobel laureate Zhores Alferov - write here about the fundamental concepts behind nano-optoelectronics, the material basis, physical phenomena, device physics and systems.

Functional Glasses and Glass-Ceramics: Processing, Properties and Applications provides comprehensive coverage of the current state-of-the-art on a range of material synthesis. This work discusses the functional properties and applications of both oxide and non-oxide glasses and glass-ceramics. Part One provides an introduction to the basic concept of functional glasses and glass-ceramics, while Part Two describes the functional glasses and glass-ceramics of oxide systems, covering functionalization of glasses by 3d transition metal ion doping, 4f rare earth metal ion doping, crystallization, laser irradiation micro fabrication, incorporation of nanometals, the incorporation of semiconductor coatings, the functionalization for biomedical applications, solid oxide fuel cell (SOFC) sealants, and display devices, and from waste materials. Part Three describes functional glasses and glass-ceramics of non-oxide systems, covering functional chalcogenide and functional halide glasses, glass-ceramics, and functional bulk metallic glasses. The book contains future outlooks and exercises at the end of each chapter, and can be used as a reference for researchers and practitioners in the industry and those in post graduate studies. Provides a comprehensive text that explores the field of both functional glass and glass ceramics Presents an in-depth discussion on the definition of a functional glass Includes discussions of advanced processing, functional properties, and functional applications of a wide array of functional glasses and glass-ceramics Written using a systematic approach that can only be accomplished through an authored work

The book describes the most advanced techniques for generating coherent light in the mid-infrared region of the spectrum. These techniques represent diverse areas of photonics and include heterojunction semiconductor lasers, quantum cascade lasers, tunable crystalline lasers, fiber lasers, Raman lasers, and optical parametric laser sources. Offering authoritative reviews by internationally recognized experts, the book provides a wealth of information on the essential principles and methods of the generation of coherent mid-infrared light and on some of its applications. The instructive nature of the book makes it an excellent text for physicists and practicing engineers who want to use mid-infrared laser sources in spectroscopy, medicine, remote sensing and other fields, and for researchers in various disciplines requiring a broad introduction to the subject.

Over the last few years, there has been a convergence between the fields of ultrafast science, nonlinear optics, optical frequency metrology, and precision laser spectroscopy. These fields have been developing largely independently since the birth of the laser, reaching remarkable levels of performance. On the ultrafast frontier, pulses of only a few cycles long have been produced, while in optical spectroscopy, the precision and resolution have reached one part in Although these two achievements appear to be completely disconnected, advances in nonlinear optics provided the essential link between them. The resulting convergence has enabled unprecedented advances in the control of the electric field of the pulses produced by femtosecond mode-locked lasers. The corresponding spectrum consists of a comb of sharp spectral lines with well-defined frequencies. These new techniques and capabilities are generally known as “femtosecond comb technology. ” They have had dramatic impact on the diverse fields of precision measurement and extreme nonlinear optical physics. The historical background for these developments is provided in the Foreword by two of the pioneers of laser spectroscopy, John Hall and Theodor Hänsch. Indeed the developments described in this book were foreshadowed by Hänsch’s early work in the 1970s when he used picosecond pulses to demonstrate the connection between the time and frequency domains in laser spectroscopy. This work complemented the advances in precision laser stabilization developed by Hall.

Introduces the technology and reviews the experimental issues; a valuable reference for graduate students and researchers in physics and astrophysics.

Offering the latest information in magnetic nanoparticle (MNP) research, this book builds upon the success of the first volume and provides an updated and comprehensive review, from synthesis, characterization, and biofunctionalization to clinical applications of MNPs, including the diagnosis and treatment of cancers. The book captures some of emerging research area which was not available in the first volume. Good Manufacturing Practices and Commercialization of MNPs are also included. This volume, also written by some of the most qualified experts in the field, incorporates new developments in the literature, and continues to bridge the gaps between the different areas in this field.

During recent years our enthusiasm for this field has continually increased. This book presents expert contributions describing the fundamental principles for the widespread use of radiative decay engineering in the biological sciences and nanotechnology.

The investigation of the properties of condensed matter using experimental nuclear methods is becoming increasingly important. An extremely broad range of techniques is used, including the use of particles, such as positrons and neutrons, ion beams, and the detection of radiation from nuclear decays or nuclear reactions. Nuclear Condensed Matter Physics: Nuclear Methods and Applications is the only book to provide a comprehensive coverage of the nuclear methods used to study the properties of condensed matter. It covers all the key techniques, including the Mossbauer effect, perturbed angular correlation, muon spin rotation, neutron scattering, positron annihilation, nuclear magnetic resonance and ion beam analysis. Numerous examples are given throughout the text to illustrate how each of the experimental methods is used in modern condensed matter physics, and practical details concerning instrumentation are included to help the reader apply each method. Nuclear Condensed Matter

Physics: Nuclear Methods and Applications is an invaluable textbook for graduate students of condensed matter physics and chemistry, and is of great interest to those studying materials science and applied nuclear physics. It is also a key reference source for more experienced researchers in these and related fields, including nuclear and condensed matter physicists and solid state and inorganic chemists.

As the editor, I feel extremely happy to present to the readers such a rich collection of chapters authored/co-authored by a large number of experts from around the world covering the broad field of guided wave optics and optoelectronics. Most of the chapters are state-of-the-art on respective topics or areas that are emerging. Several authors narrated technological challenges in a lucid manner, which was possible because of individual expertise of the authors in their own subject specialties. I have no doubt that this book will be useful to graduate students, teachers, researchers, and practicing engineers and technologists and that they would love to have it on their book shelves for ready reference at any time.

Graphene is giving new impetus to the electronics industry because its band structure allows its properties to be dramatically altered and modified by chemical or electrochemical doping methods. This book provides a comprehensive source of information about graphene as a phenomenon, its physics and its mechanical and chemical properties in the light of the latest scientific and technological discoveries. The major focus of the book is on military and special applications since that is where the biggest investments are made.

The field of ultrafast nonlinear optics is broad and multidisciplinary, and encompasses areas concerned with both the generation and measurement of ultrashort pulses of light, as well as those concerned with the applications of such pulses. Ultrashort pulses are extreme events – both in terms of their durations, and also the high peak powers which their short durations can facilitate. These extreme properties make them powerful experiment tools. On one hand, their ultrashort durations facilitate the probing and manipulation of matter on incredibly short timescales. On the other, their ultrashort durations can facilitate high peak powers which can drive highly nonlinear light-matter interaction processes. Ultrafast Nonlinear Optics covers a complete range of topics, both applied and fundamental in nature, within the area of ultrafast nonlinear optics. Chapters 1 to 4 are concerned with the generation and measurement of ultrashort pulses. Chapters 5 to 7 are concerned with fundamental applications of ultrashort pulses in metrology and quantum control. Chapters 8 and 9 are concerned with ultrafast nonlinear optics in optical fibres. Chapters 10 to 13 are concerned with the applications of ultrashort pulses in areas such as particle acceleration, microscopy, and micromachining. The chapters are aimed at graduate-student level and are intended to provide the student with an accessible, self-contained and comprehensive gateway into each subject.

The second, updated edition of this essential reference book provides a wealth of detail on a wide range of electronic and photonic materials, starting from fundamentals and building up to advanced topics and applications. Its extensive coverage, with clear illustrations and applications, carefully selected chapter sequencing and logical flow, makes it very different from other electronic materials handbooks. It has been written by professionals in the field and instructors who teach the subject at a university or in corporate laboratories. The Springer

Handbook of Electronic and Photonic Materials, second edition, includes practical applications used as examples, details of experimental techniques, useful tables that summarize equations, and, most importantly, properties of various materials, as well as an extensive glossary. Along with significant updates to the content and the references, the second edition includes a number of new chapters such as those covering novel materials and selected applications. This handbook is a valuable resource for graduate students, researchers and practicing professionals working in the area of electronic, optoelectronic and photonic materials.

Edited by the two top experts in the field with a panel of International contributors, this is a comprehensive up-to-date review of research and applications. Starting with the basic physical principles of laser cooling of solids, the monograph goes on to discuss the current theoretical issues being resolved and the increasing demands of growth and evaluation of high purity materials suitable for optical refrigeration, while also examining the design and applications of practical cryocoolers. An advanced text for scientists, researchers, engineers, and students (masters, PHDs and Postdoc) in laser and optical material science, and cryogenics.

Optical RefrigerationScience and Applications of Laser Cooling of SolidsJohn Wiley & Sons

This book provides a broad overview of photonic crystals and, as the title suggests, covers their principles and applications. It is written from a physics point of view with an emphasis on materials science. Equations are well explained and often completely avoided to increase the readability of the book. The book is divided into eight chapters, starting with a brief introduction. The second chapter deals with different dimensionalities of the photonic crystals and their properties. The third chapter is very interestingly written and provides a survey of the various synthesis methods used for production of photonic crystals, including chemical routes, lithography, and self-assembly of colloidal photonic crystals. Chapters 4–8 constitute the bulk of the book and provide examples of applications of these photonic crystals. Chapter 4 offers a good explanation of optical switching. Bandgap and defect mode switching are also brought into focus along with many other mechanisms—14 different switching mechanisms in all, including thermal, electro, and magneto switching. Frequency tuning of photonic crystal filters with special attention to nanosize photonic crystals is illustrated, providing a direct perspective on applications of these materials in integrated photonic circuits. The transition from chapter 5 to 6 dealing with photonic crystal lasers is smooth, especially after a clear description of frequency tuning. Here, one- to three-dimensional photonic lasers are explained along with laser oscillations produced by a variety of microcavity methods. Metallodielectric and liquid-crystal photonic lasers are equally well illustrated. Chapter 7 introduces logic devices based on photonic crystals. This chapter clearly explains, with the help of simple illustrations, how to obtain AND, OR, and XOR logic gates. Chapter 8 concludes the book by presenting possible applications, including gas, chemical, fluid, and cell sensing; their workings are very well described from a fundamental point of view. The diagrams and illustrations are appropriate and eye catching. There are ample references; thus readers are able to find more detailed information to satisfy their curiosity if the book does not suffice. Even though the introduction provides basics of these photonic crystals, I do get the impression that the bigger picture is missing. A nonexpert may not understand the direct application of such materials right from the beginning of the book. A flowchart or a diagram of these photonic crystals, illustrating applications in daily life at the beginning of the book, could attract a broader readership. In this regard, I believe that this book is most adapted to physicists with a materials science background or vice versa. However, one should take into consideration that the principles of photonic crystals cannot be explained without physics, and therefore the quality of this book remains intact and could very well serve as a textbook for future physicists.