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Linear and Nonlinear Optical Properties of High Refractive Index Dielectric Nanostructures
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Nonlinear Optical Properties of Materials
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Principles and Applications of Nonlinear Optical Materials
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The Non-Linear Optical Properties of Crystals and Molecules

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Characterization Techniques and Tabulations for Organic Nonlinear Optical Materials CRC Press
This Field Guide is designed for those looking for a condensed and concise source of key concepts, equations, and techniques for nonlinear optics. Examples throughout this Field Guide illustrate fundamental concepts while demonstrating the application of key equations. Topics covered include technologically important effects, recent developments in nonlinear optics, and linear optical properties central to nonlinear phenomena, with a focus on real-world applicability in the field of nonlinear optics.
Linear and Non-linear Optical Properties of Cylindrical Micro-resonators Springer
This book is mostly concerned on the experimental research of the nonlinear optical characteristics of various media, low- and high-order harmonic generation in different materials, and formation, and nonlinear optical characterization of clusters. We also demonstrate the inter-connection between these areas of nonlinear optics. Nonlinear optical properties of media such as optical limiting can be applied in various areas of science and technology. To define suitable materials for these applications, one has to carefully analyse the nonlinear optical characteristics of various media, such as the nonlinear refractive indices, coefficients of nonlinear absorption, saturation absorption intensities, etc. Knowing the nonlinear optical parameters of materials is also important for describing the propagation effects, self-interaction of intense laser pulses, and optimisation of various nonlinear optical processes. Among those processes one can admit the importance of the studies of the frequency conversion of coherent laser sources. The area of interest for nonlinear optical characterization of materials is also closely related with new field of nanostructures formation and application during laser-matter interaction. We show how the nonlinear optical analysis of materials leads to improvement of their high-order nonlinear optical response during the interaction with strong laser fields. Ablation-induced nanoparticles formation is correlated with their applications as efficient sources of coherent short-wavelength photons. From other side, recent achievements of harmonic generation in plasmas are closely related with the knowledge of the properties of materials in the laser plumes. All of these studies are concerned with the low-order nonlinear optical features of various materials. The novelty of the approach developed in present book is related with inter-connection of those studies with each other.
Nonlinear Optical Properties of Traditional and Novel Materials Springer
The object of the present research is to design and fabricate metal-dielectric thin film multilayer structures that make use of the nonlinear optical (NLO) response of Ag for efficient nonlinear absorption for sensor protection. These structures employ structural resonances to overcome the challenges of reflection and absorption that limit access to this large NLO response. The research consists of three parts: first, we present a comprehensive analysis of the contributions to the nonlinear optical response of Ag. Second, we present a systematic investigation of the linear optical properties of Metal-Dielectric Photonic Band-Gap (MDPBG) structures, including optimization of the structure for a particular transmittance spectrum. Third, we study the linear and nonlinear optical properties of Induced Transmission Filters (ITFs). Each of these parts includes experimental results backed by modeling and simulation.
Field Guide to Nonlinear Optics Springer Science & Business Media
Fundamentals of Nonlinear Optics encompasses a broad spectrum of nonlinear phenomena from second-harmonic generation to soliton formation. The wide use of nonlinear optical phenomena in laboratories and commercial devices requires familiarity with the underlying physics as well as practical device considerations. This text adopts a combined approach to analyze the complimentary aspects of nonlinear optics, enabling a fundamental understanding of both a given effect and practical device applications. After a review chapter on linear phenomena important to nonlinear optics, the book tackles nonlinear phenomena with a look at the technologically important processes of second-harmonic generation, sum-frequency and difference-frequency generation, and the electro-optic effect. The author covers these processes in considerable detail at both theoretical and practical levels as the formalisms developed for these effects carry to subsequent topics, such as four-wave mixing, self-phase modulation, Raman scattering, Brillouin scattering, and soliton formation. Consistently connecting theory, process, effects, and applications, this introductory text encourages students to master key concepts and to solve nonlinear optics problems—preparing them for more advanced study. Along with extensive problems at the end of each chapter, it presents general algorithms accessible to any scientific graphical and programming package. Watch the author speak about the book.
Optical Properties of Graphene Springer Science & Business Media
This book assembles both theory and application in this field, to interest experimentalists and theoreticians alike. Part 1 is concerned with the theory and computing of non-linear optical (NLO) properties while Part 2 reviews the latest developments in experimentation. This book will be invaluable to researchers and students in academia and industry, particularlrly to anyone involved in materials science, theoretical and computational chemistry, chemical physics, and molecular physics.
Second Order Nonlinearity and Laser-induced Optical Properties of Nonlinear Optical Materials CRC Press
Metamaterials are materials whose optical properties can be designed through the accurate engineering of their structure on the subwavelength scale. They have enabled the discovery and study of a variety of interesting new optical properties not normally present in materials found in nature. Furthermore, by designing the local electromagnetic field distributions of such metamaterials, it is possible to engineer not only their linear optical properties but also their nonlinear response, which is fundamental for the development of nonlinear and active nanophotonics for all-optical information processing. In this thesis I will show that plasmonic metamaterials based on metallic nanorod arrays can be designed to have strong third-order nonlinear optical response originating from the nonlinearity of the plasmonic component of the metamaterial, allowing nonlinear

processes to be more energy efficient and highly integrated. The nonlinearity will be experimentally determined through the z-scan technique and explained by numerical modeling in both effective medium and fullvectorial simulations. Enhancements of about 50 times for the nonlinear absorption and about 10 times for the nonlinear refraction are observed compared to a smooth metal film. Furthermore, the properties of waveguides comprised of the nanorod metamaterial are studied and the possibility of their integration in conventional Si photonic waveguides is demonstrated. In this context, two all-optical modulators using plasmonic metamaterials are designed, operating in the hyperbolic and epsilon near-zero regimes. Both designs are highly integrated and energy efficient having footprints of 300x440x600 nm3 and 300xl80x340 nm3 with an energy consumption of 3.7 pJ/bit and 0.6pJ/bit respectively. The obtained results show great opportunities for nonlinear metamaterials in nanophotonic applications.

Linear and Nonlinear Optical Properties of Novel Organic Crystals CRC Press

""Furnishes table of nonlinear optical properties of organic substances as well as experimental procedures for measuring the nonlinearity of the elements tabulated, including composite materials-offering support for scientists and engineers involved in characterizing, optimizing, and producing materials for manufacturing optical devices.

Organic Nonlinear Optical Materials Elsevier

Mathematical methods play a significant role in the rapidly growing field of nonlinear optical materials. This volume discusses a number of successful or promising contributions. The overall theme of this volume is twofold: (1) the challenges faced in computing and optimizing nonlinear optical material properties; and (2) the exploitation of these properties in important areas of application. These include the design of optical amplifiers and lasers, as well as novel optical switches. Research topics in this volume include how to exploit the magnetooptic effect, how to work with the nonlinear optical response of materials, how to predict laser-induced breakdown in efficient optical devices, and how to handle electron cloud distortion in femtosecond processes.

The elongation method Routledge

Nonlinear Optical Properties of Organic Molecules and Crystals V1 ...

Fundamentals of Nonlinear Optics LAP Lambert Academic Publishing

Photonics, the counterpart of electronics, involves the usage of Photons instead of electrons to process information and perform various switching operations. Photonics is projected to be the technology of the future because of the gain in speed, processing and interconnectivity of network. Nonlinear optical processes will play the key role in photonics Where they can be used for frequency conversion, optical switching and modulation. Organic molecules and polymers have emerged as a new class of highly promising nonlinear optical materials Which has captured the attention of scientists world wide. The organic systems offer the advantage of large nonresonant nonlinearities derived from the 1T electrons contribution, femtosecond response time and the flexibility to modify their molecular structures. In addition, organic polymers can easily be fabricated in various device structures compatible with the fiber-optics communication system. The area of nonlinear optics of organic molecules and polymers offers exciting opportunities for both fundamental research and technologic development. It is truly an interdisciplinary area. This proceeding is the outcome of the first NATO Advanced Research WOrkshop in this highly important area. The objective of the workshop was to provide a forum for scientists of varying background from both universities and industries to come together and interface their expertize. The scope of the workshop was multidisciplinary with active participations from Chemists, physicists, engineers and materials scientists from many countries.

Non-linear Optical Properties of Matter CRC Press

Contemporary Nonlinear Optics discusses the different activities in the field of nonlinear optics. The book is comprised of 10 chapters. Chapter 1 presents a description of the field of nonlinear guided-wave optics. Chapter 2 surveys a new branch of nonlinear optics under the heading optical solitons. Chapter 3 reviews recent progress in the field of optical phase conjugation. Chapter 4 discusses ultrafast nonlinear optics, a field that is growing rapidly with the ability of generating and controlling femtosecond optical pulses. Chapter 5 examines a branch of nonlinear optics that may be termed nonlinear quantum optics. Chapter 6 reviews the new field of photorefractive adaptive neural networks. Chapter 7 presents a discussion of recent successes in the development of nonlinear optical media based on organic materials. Chapter 8 reviews the field of nonlinear optics in quantum confined structures. Chapter 9 reviews the field of nonlinear laser spectroscopy, with emphasis on advances made during the 1980s. Finally, Chapter 10 reviews the field of nonlinear optical dynamics by considering nonlinear optical systems that exhibit temporal, spatial, or spatio-temporal instabilities. This book is a valuable source for physicists and other scientists interested in optical systems and neural networks.

From Materials to Device Realisation World Scientific

The Optical Society of America (OSA) and SPIE – The International Society for Optical Engineering have awarded Robert Boyd with an honorable mention for the Joseph W. Goodman Book Writing Award for his work on Nonlinear Optics, 2nd edition. Nonlinear optics is essentially the study of the interaction of strong laser light with matter. It lies at the basis of the field of photonics, the use of light fields to control other light fields and to perform logical operations. Some of the topics of this book include the fundamentals and applications of optical systems based on the nonlinear interaction of light with matter. Topics to be treated include: mechanisms of optical nonlinearity, second-harmonic and sum- and difference-frequency generation, photonics and optical logic, optical self-action effects including self-focusing and optical soliton formation, optical phase conjugation, stimulated Brillouin and stimulated Raman scattering, and selection criteria of nonlinear optical materials. · Covers all the latest topics and technology in this ever-evolving area of study that forms the backbone of the major applications of optical technology · Offers first-rate instructive style making it ideal for self-study · Emphasizes the fundamentals of non-linear optics rather than focus on particular applications that are constantly changing

Nonlinear Optical Properties of Organic Molecules and Crystals Springer Science & Business Media

Organic Nonlinear Optical Materials provides an extensive description of the preparation and characterization of organic materials for applications in nonlinear and electro-optics. The book discusses the fundamental optimization and practical limitations of a number of figures of merit for various optical parameters and gives a clinical appraisal of the potential of organic materials for applicators in optical technology. Among the topics addressed are the basic molecular design of ;nonlinear

optical chromophores, fundamentals and novel techniques of organic crystal growth, preparation and characterization of Langmuir-Blodgett and polymer films, experimental methods for determining microscopic and macroscopic optical properties. Also included is a discussion of first results of the photorefractive effect in organic crystals and the potential of organics for photorefractive applications, as well as an extensive review of published linear and nonlinear optical measurement of organic materials.

Nonlinear Optical Effects in Organic Polymers CRC Press
This book assembles both theory and application in this field, to interest experimentalists and theoreticians alike. Part 1 is concerned with the theory and computing of non-linear optical (NLO) properties while Part 2 reviews the latest developments in experimentation. This book will be invaluable to researchers and students in academia and industry, particularlrly to anyone involved in materials science, theoretical and computational chemistry, chemical physics, and molecular physics.

Nonlinear Optical Properties of Organic Molecules and Crystals World Scientific
This book provides a comprehensive state-of-the-art overview of the optical properties of graphene. During the past decade, graphene, the most ideal and thinnest of all two-dimensional materials, has become one of the most widely studied materials. Its unique properties hold great promise to revolutionize many electronic, optical and opto-electronic devices. The book contains an introductory tutorial and 13 chapters written by experts in areas ranging from fundamental quantum mechanical properties to opto-electronic device applications of graphene.

Materials, Properties, and Applications Society of Photo Optical
In this work optical properties of two dimensional quantum well structures are studied. Variational calculation of the eigenstates in an isolated quantum well structure with and without the external electrical field is presented. At weak fields a quadratic Stark shift is found whose magnitude depends strongly on the finite well depth. It is observed that under external electrical field, the asymmetries due to lack of inversion symmetry leads to higher order nonlinear optical effects such as second order optical polarization and second order optical susceptibility.

Optics and Nonlinear Optics of Liquid Crystals Elsevier
Nonlinear Optical Properties of Organic Molecules and Crystals, Volume 1 discusses the nonlinear optical effects in organic molecules and crystals, providing a classical distinction between quadratic and cubic processes. This book begins with a general overview of the basic properties of organic matter, followed by a review on the benefits derived from quantum-chemistry-based models and growth and characterization of high quality, bulk organic crystals and waveguided structures. A case study focusing on a specific material, namely urea, which exemplifies a situation in which transparency in the UV region has been purposely traded for nonlinear efficiency is also deliberated. This text concludes with a description of a type of trade-off between the unpredictable orientation of molecules in crystalline media, polarity of liquid-crystalline structures, and dominant electronic contribution to the electro-optic effect. This publication is beneficial to solid-state physicists and chemists concerned with nonlinear optical properties of organic molecules and crystals.

Linear and Non-linear Optical Properties of Electro-optic Crystals Springer Science & Business Media
In recent years, optical properties of the unique atomic and molecular structures of materials have drawn great scientific interest. Linear optical properties of materials such as metals, metal oxides, magnetic oxides, and organic materials are based on energy transfer and find applications in wastewater treatment, forensic science, biomedical science, photovoltaics, nuclear technology, and LED displays. Nonlinear optical properties of materials are based on the nonlinear medium and find more advanced applications in frequency mixing generations and optical parametric oscillations. This book presents the underlying principles, implementation, and applications of the linear and nonlinear optical properties of materials and has been divided into two parts emphasizing these properties. The first part of the book, Linear Optics, discusses bimetallic nanoparticles in dielectric media and their integration to dye molecules to detect trace amounts of heavy metals at the nanometer level, as well as to enhance luminescence and image contrasts in forensic inspection and biomedical diagnosis. It shows how the integration of bimetallic nanoparticles into a ZnO matrix promotes broadening of the absorption spectrum from the ultraviolet to the visible wavelength. It explains the role of surface adsorption and photocatalytic degradation in dye-removal kinetics by Fe3O4 magnetic nanoparticles under pulsed white light. It also discusses the double-layer shielding tank design to safely store radioactive waste and photon propagation through the multilayer structures of a human tissue model. The second part of the book, Nonlinear Optics, presents general concepts such as electromagnetic theory, nonlinear medium, and wave propagation, as well as more advanced concepts such as second harmonic generation, phase matching, optical parametric interactions, different frequency generation, sum frequency generation, tunable laser, and optical resonant oscillator.

Linear and Nonlinear Optical Properties of Metal-dielectric Multilayer Structures Academic Press
Non-Linear Optical Properties of MatterFrom molecules to condensed phasesSpringer Science & Business Media
Elsevier
Nonlinear optics is a topic of much current interest that exhibits a great diversity. Some publications on the subject are clearly physics, while others reveal an engineering bias; some appear to be accessible to the chemist, while others may appeal to biological understanding. Yet all purport to be non linear optics so where is the underlying unity? The answer is that the unity lies in the phenomena and the devices that exploit them, while the diversity lies in the materials used to express the phenomena. This book is an attempt to show this unity in diversity by bringing together contributions covering an unusually wide range of materials, preceded by accounts of the main phenomena and important devices. Because ofthe diversity, individual materials are treated in separate chapters by different expert authors, while as editors we have shouldered the task of providing the unifying initial chapters. Most main classes of nonlinear optical solids are treated: semiconductors, glasses, ferroelectrics, molecular crystals, polymers, and Langmuir-Blodgett films. (However, liquid crystals are not covered.) Each class of material is enough for a monograph in itself, and this book is designed to be an introduction suitable for graduate students and those in industry entering the area of nonlinear optics. It is also suitable in parts for final-year undergraduates on project work. It aims to provide a bridge between traditional fields of expertise and the broader field of nonlinear optics.