excite electrons from the valence band to these phonon-excited states, these transitions are electric-dipole-forbidden; hence, a DPP can be generated in nanometer-sized (quantum confinement) semiconductor materials that can excite multiple modes of coherent phonons around nanometer-sized structures. In an ideal DPP-assisted process, two-step excitation from the valence band to the conduction band is realized via an intermediate phonon state, and the energy required to create electron–hole pairs is therefore smaller than the bandgap energy.

Chapter 1 lays out the strategy and a case for the book, stating the problems with conventional light-emitting devices and their respective solutions. It also defines the DP, DPP, and photon breeding concepts. Conventional optical technology has used propagating light merely as a tool instead of exploring new types of light. In contrast, DP technology was born as a result of exploring a new type of light (i.e., the DP). Since conventional classical and quantum theories of light cannot be directly applied to describe the DP, novel concepts and theoretical bases are required.

Chapter 2 discusses fabrication and operation of visible LEDs using silicon crystals. Discussions include approaches for increasing light extraction efficiency. Chapter 3 describes infrared LEDs using silicon crystals, emphasizing the fabrication and operation of these devices. The chapter also covers spatial distribution of dopants, such as boron, in the device layers, as well as some plans for ways to improve effective polarization and control.

Chapter 4 covers the contribution and control of coherent phonons and evaluates light emission spectra. Chapter 5 illustrates basic device structures for infrared lasers using silicon crystals. The chapter also discusses ways to decrease the threshold current density and evaluation of optical amplification quantities. It provides thoughts on novel devices with high output optical power using indirect-bandgap semiconductors such as silicon-using DPPs. Chapter 6 discusses silicon carbide as green, ultraviolet, or broad spectral width LEDs using the DPP-assisted process in bulk crystals.

Chapter 7 gives examples using other crystals, such as GaP and ZnO. Optimum conditions for DPP-assisted annealing are discussed separately for each semiconductor and are assessed in terms of performance.

Chapter 8 reviews applications of the DPP-assisted technique to other devices, such as oscillators, photodetectors, and polarization rotators. This chapter stresses the utility of this new DPP technique outside of LEDs and laser devices.

This book (considered a monograph) has good flow and in-depth content to target a broad audience, including students, professors, academic researchers, and industry folks. It includes many current references for experimentalists and provides mathematical definitions in the appendices for theoreticians. My only critique is that the book could have been organized a little differently by placing figures and tables in places more relevant to the corresponding text. It is a good read for anybody who wants to learn about DPP-assisted silicon light-emitting devices and lasers.

***Reviewer: Sudip Mukhopadhyay*** *is a Honeywell Fellow at Honeywell, Calif., USA.*

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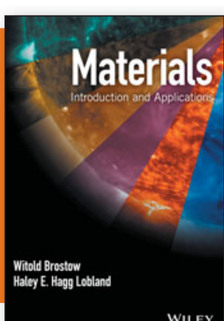


**Materials: Introduction and Applications**

Witold Brostow and Haley E. Hagg Lobland

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This book is an excellent introduction to the field of materials science and engineering for students and newcomers. It covers a combination of basic and advanced materials concepts and applications. Chapter 1 introduces the historical background of materials science and engineering and its role in society. Chapter 2 discusses the intermolecular forces, including physical interactions and chemical bonding. Chapter 3 discusses the fundamentals of thermodynamics and different types of phase diagrams. Chapters 4 and 5 deal with the structure and fundamentals of crystalline, non-crystalline, and porous materials. Chapters 6–12 provide an overview of descriptions of details of the structures and fabrication methods for different types of materials, devoting a chapter to each of the following: metals, ceramics, organic raw materials, polymers, composites, biomaterials, and liquid crystals and smart materials. Chapters 13–19 detail the fundamentals and theoretical background of the behaviors and properties of materials, devoting a chapter to each of the following: rheological properties, mechanical properties, thermophysical properties, color and optical properties, electronic properties, magnetic properties, and surface behavior and tribology. Chapter 20 describes the recycling and degradation of materials in the environment. Chapter 21 summarizes the different materials testing techniques, including standard testing and microscopy testing methods.

This textbook is a good resource that provides the fundamentals of materials science and engineering supported by examples, problems, and adequate references for students. It will also serve as an important addition to the libraries of those interested in understanding materials science and engineering and their advanced applications.

***Reviewer: Walid M. Daoush*** *of Helwan University, Egypt.*


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