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Autore	Kitai Adrian
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Nota di contenuto	Principles of Solar Cells, LEDs and Diodes; Contents; Introduction; Acknowledgements; 1 Semiconductor Physics; 1.1 Introduction; 1.2 The Band Theory of Solids; 1.3 The Kronig-Penney Model; 1.4 The Bragg Model; 1.5 Effective Mass; 1.6 Number of States in a Band; 1.7 Band Filling; 1.8 Fermi Energy and Holes; 1.9 Carrier Concentration; 1.10 Semiconductor Materials; 1.11 Semiconductor Band Diagrams; 1.12 Direct Gap and Indirect Gap Semiconductors; 1.13 Extrinsic Semiconductors; 1.14 Carrier Transport in Semiconductors; 1.15

## Equilibrium and Non-Equilibrium Dynamics

1.16 Carrier Diffusion and the Einstein Relation; 1.17 Quasi-Fermi Energies; 1.18 The Diffusion Equation; 1.19 Traps and Carrier Lifetimes; 1.20 Alloy Semiconductors; 1.21 Summary; Suggestions for Further Reading; Problems; 2 The PN Junction Diode; 2.1 Introduction; 2.2 Diode Current; 2.3 Contact Potential; 2.4 The Depletion Approximation; 2.5 The Diode Equation; 2.6 Reverse Breakdown and the Zener Diode; 2.7 Tunnel Diodes; 2.8 Generation/Recombination Currents; 2.9 Ohmic Contacts, Schottky Barriers and Schottky Diodes; 2.10 Heterojunctions; 2.11 Alternating Current (AC) and Transient Behaviour; 2.12 Summary; Suggestions for Further Reading; Problems; 3 Photon Emission and Absorption; 3.1 Introduction to Luminescence and Absorption; 3.2 Physics of Light Emission; 3.3 Simple Harmonic Radiator; 3.4 Quantum Description; 3.5 The Exciton; 3.6 Two-Electron Atoms; 3.7 Molecular Excitons; 3.8 Band-to-Band Transitions; 3.9 Photometric Units; 3.10 Summary; Suggestions for Further Reading; Problems; 4 The Solar Cell; 4.1 Introduction; 4.2 Light Absorption; 4.3 Solar Radiation; 4.4 Solar Cell Design and Analysis; 4.5 Thin Solar Cells; 4.6 Solar Cell Generation as a Function of Depth; 4.7 Solar Cell Efficiency; 4.8 Silicon Solar Cell Technology: Wafer Preparation; 4.9 Silicon Solar Cell Technology: Solar Cell Finishing; 4.10 Silicon Solar Cell Technology: Advanced Production Methods; 4.11 Thin Film Solar Cells: Amorphous Silicon; 4.12 Telluride/Selenide/Sulphide Thin-Film Solar Cells; 4.13 High-Efficiency Multijunction Solar Cells; 4.14 Concentrating Solar Systems; 4.15 Summary; Suggestions for Further Reading; Problems; 5 Light Emitting Diodes; 5.1 Introduction; 5.2 LED Operation and Device Structures; 5.3 Emission Spectrum; 5.4 Non-Radiative Recombination; 5.5 Optical Outcoupling; 5.6 GaAs LEDs; 5.7 GaAs<sub>1-x</sub>P<sub>x</sub> LEDs; 5.8 Double Heterojunction Al<sub>x</sub>Ga<sub>1-x</sub>As LEDs; 5.9 AlGaInP LEDs; 5.10 Ga<sub>1-x</sub>In<sub>x</sub>N LEDs; 5.11 LED Structures for Enhanced Outcoupling and Power Output; 5.12 Summary; Suggestions for Further Reading; Problems; 6 Organic Semiconductors, OLEDs and Solar Cells; 6.1 Introduction to Organic Electronics; 6.2 Conjugated Systems; 6.3 Polymer OLEDs; 6.4 Small-Molecule OLEDs; 6.5 Anode Materials; 6.6 Cathode Materials; 6.7 Hole Injection Layer; 6.8 Electron Injection Layer; 6.9 Hole Transport Layer; 6.10 Electron Transport Layer; 6.11 Light Emitting Material Processes

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### Sommario/riassunto

The book will cover the two most important applications of semiconductor diodes - solar cells and LEDs - together with quantitative coverage of the physics of the PN junction at the senior undergraduate level. It will include: Review of semiconductor physics; Introduction to PN diodes; The solar cell; Physics of efficient conversion of sunlight into electrical energy; Semiconductor solar cell materials and device physics; Advanced solar cell materials and devices; The light emitting diode; Physics of efficient conversion of electrical energy into light; Semiconductor li

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