

Physics of Solar Cells: From Principles to New Concepts

Peter Würfel

(Wiley-VCH, 2005)

198 pages; \$75.00

ISBN 3-527-40428-7

Peter Würfel's book explains the physics and theory behind how solar cells convert solar energy into electricity. While by no means an all-inclusive work about the subject, it treats solar cells in a manner that will give graduate students and researchers a solid review of the theory of these devices using physics and thermodynamics arguments.

After an introductory chapter to motivate the need for solar energy as an electrical power source, the explanation of solar cells begins with the physics behind black-body radiation and absorption. Concepts are gradually built upon with discussions on energy conversion, semiconductors, and recombination processes to provide a clear picture of what is required for efficient solar energy conversion. In this manner, the necessary equations to describe the operation of solar cells are derived, starting from basic theories and assumptions.

The book excels at explaining how solar cells work from the perspective of thermodynamic and electrochemical requirements. Methods for calculating fundamental efficiency limits for idealized materials systems and device architectures are also detailed for both common and radical device configurations. However, some arguments may be difficult for those with a weak physics background to completely appreciate.

Though the book never claims to be an exhaustive text, it should be mentioned that it does not cover fabrication processes currently being employed nor provide a review of the multitude of device architectures and materials systems being used and researched. The theories behind the most efficient and novel approaches are presented, but this book would not suffice as a handbook on solar cell design, fabrication, real-world application, and modeling.

Overall, the book nicely complements engineering texts in the subject to give a fresh perspective on the physics and theory of converting solar energy into electricity. The structure of the book may be especially useful as a starting point for those trying to describe nontraditional materials systems such as organic solar cells.

Reviewers: Bernard Kippelen is a professor of electrical and computer engineering at the Georgia Institute of Technology. William J. Potscavage, Jr. is a graduate student in Kippelen's research group and is working on next-generation organic solar cells.

The following recently published books, relevant to materials research, have come to *MRS Bulletin's* attention. Some of the books listed here may be reviewed in future issues of *MRS Bulletin*. To review a book from the list or to offer recommendations of additional books, contact Editorial Assistant, *MRS Bulletin*, 506 Keystone Drive, Warrendale, PA 15086-7573, USA; e-mail bulletin@mrs.org.

Applications of Materials

Handbook of Antistatics, Jürgen Pionteck and George Wypych, William Andrew Publishing, 2007, 359 pp., \$275.00, ISBN 1-895198-34-8.

Membrane Technology: In the Chemical Industry, 2nd Edition, Suzana Pereira Nunes and Klaus-Viktor Peinemann, Editors, Wiley, 2006, 354 pp., \$165.00, ISBN 3-527-31316-8.

Photorefractive Materials, Jaime Frejlich, Wiley, 2006, 309 pp., \$115.00, ISBN 0-471-74866-8.

Photorefractive Materials and Their Applications, 2, Peter Günter and Jean Pierre Huignard, Editors, Springer, 2007, 646 pp., \$149.00, ISBN 0-387-33924-8.

Smart Material Systems and MEMS, Design and Development Methodologies, Vijay Varadan, K.J. Vinoy, and S. Gopalakrishnan, Wiley, 2002, 406 pp., \$145.00, ISBN 0-470-84308-X.

Springer Handbook of Electronic and Photonic Materials, Safa Kasap and Peter Capper, Editors, Springer, 2007, 1406 pp., \$199.00, ISBN 0-387-26059-5.

Springer Handbook of Nanotechnology, Bharat Bhushan, Editor, Springer, 2007, 1916 pp., \$199.00, ISBN 3-540-29855-X.

Biomaterials

Fundamentals of BioMEMS and Medical Microdevices, Steven S. Saliterman, Wiley, 2006, 576 pp., \$99.00, ISBN 0-8194-5977-1.

Organometallics, 3rd Edition, Christoph Elschenbroich, Wiley, 2006, 818 pp., \$95.00, ISBN 3-527-29390-6.

Experimental Techniques

Optics and Spectroscopy at Surfaces and Interfaces, Vladimir G. Bordo and Horst-Günter Rubahn, Wiley, 2005, 282 pp., \$75.00, ISBN 3-527-40560-7.

Science of Microscopy, P.W. Hawkes and John C.H. Spence, Editors, Springer, 2007, 1318 pp., \$695.00, ISBN 0-387-25296-7.

Springer Handbook of Materials Measurement Methods, Horst Czichos, Tetsuya Saito, and Leslie Smith, Editors, Springer, 2006, 1208 pp., \$199.00, ISBN 3-540-20785-6.

Materials Processing

3D Laser Microfabrication, Principles and Applications, Hiroaki Misawa and Saulius Juodkazis, Editors, Wiley, 2005, 404 pp., \$180.00, ISBN 3-527-31055-X.

Laser Ablation and Its Applications, Claude R. Phipps, Editor, Springer, 2007, 588 pp., \$139.00, ISBN 0-387-30452-5.

Nanotechnology for Electronic Materials and Devices, A. Korkein, E. Gusev, J.K. Labanowski, and S. Luryi, Editors, Springer, 2007, 375 pp., \$129.00, ISBN 0-387-23349-0.

Pulsed Laser Deposition of Thin Films, Robert Eason, Editor, Wiley, 2006, 682 pp., \$175.00, ISBN 0-471-44709-9.

Physics and Electronics

Electronic and Optical Properties of *d*-Band Perovskites, Thomas Wolfram and Şinasi Ellialtıođlu, Cambridge University Press, 2006, 315 pp., \$135.00, ISBN 0-521-85053-3.

Gas Transport in Porous Media, Clifford K. Ho and Stephen W. Webb, Editors, Springer, 2006, 446 pp., \$169.00, ISBN 1-4020-3961-1.

Introductory Transport Theory for Charged Particles in Gases, Robert E. Robson, World Scientific, 2006, 196 pp., \$44.00, ISBN 981-270-011-0.

New Superconductors—From Granular to High T_c , Guy Deutscher, World Scientific, 2006, 222 pp., ISBN 981-02-3089-3.

Spin Dynamics in Confined Magnetic Structures, III, Burkard Hillebrands and Andre Thiaville, Editors, Springer, 2006, 345 pp., \$229.00, ISBN 3-540-20108-4.

Polymer Chemistry

Polarized Light in Liquid Crystals and Polymers, Toralf Scharf, Wiley, 2006, 400 pp., \$95.00, ISBN 0-471-74064-0.

Structure of Materials

The Crystal Lattice—Phonons, Solitons, Dislocations, Superlattices, Second Edition, Arnold M. Kosevich, Wiley, 2005, 356 pp., \$195.00, ISBN 3-527-40508-9.

Frontiers in Crystal Engineering, Edward R.T. Tiekink and Jagadese Vittal, Editors, Wiley, 2006, 346 pp., \$195.00, ISBN 0-470-02258-2. □

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