



Basic Semiconductor Physics

By Chihiro Hamaguchi

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When the first edition of Basic Semiconductor Physics was published in 2001, there were already many books, review papers and scientific journals dealing with various aspects of semiconductor physics. Since many of them were dealing with special aspects of newly observed phenomena or with very fundamental physics, it was very difficult to understand the advanced physics of semiconductors without the detailed knowledge of semiconductor physics. For this purpose the author published the first edition for the readers who are involved with semiconductor research and development. Basic Semiconductor Physics deals with details of energy band structures, effective mass equation and k - p perturbation, and then describes very important phenomena in semiconductors such as optical, transport, magnetoresistance, and quantum phenomena. Some of my friends wrote to me that the textbook is not only basic but advanced, and that the title of the book does not reflect the contents. However, I am still convinced that the title is appropriate, because the advanced physics of semiconductor may be understood with the knowledge of the fundamental physics. In addition new and advanced phenomena observed in semiconductors at an early time are becoming well-known and thus classified in basic physics. After the publication of the first edition, many typographical errors have been pointed out and the corrected version was published in 2006. The publisher and my friends persuade me to revise the book adding new chapters, keeping the subject at the appropriate level.

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Editorial Review

Review

"In conclusion, I would say that this book is a nice presentation of today's basic principles needed for a proper starting in the field of modern semiconductor physics."

--Physicalia

From the Back Cover

This book presents a detailed description of the basic semiconductor physics. The reader is assumed to have a basic command of mathematics and some elementary knowledge of solid state physics. The text covers a wide range of important phenomena in semiconductors, from the simple to the advanced. The reader can understand three different methods of energy band calculations, empirical pseudo-potential, k.p perturbation and tight-binding methods. The effective mass approximation and electron motion in a periodic potential, Boltzmann transport equation and deformation potentials used for full band Monte Carlo simulation are discussed. Experiments and theoretical analysis of cyclotron resonance are discussed in detail because the results are essential to the understanding of semiconductor physics. Optical and transport properties, magneto-transport, two dimensional electron gas transport (HEMT and MOSFET), and quantum transport are reviewed, explaining optical transition, electron phonon interactions, electron mobility. Recent progress in quantum structures such as two-dimensional electron gas, superlattices, quantum Hall effect, electron confinement and the Landauer formula are included. The Quantum Hall effect is presented with different models. In the second edition, the addition energy and electronic structure of a quantum dot (artificial atom) are explained with the help of Slater determinants. Also the physics of semiconductor Lasers is described in detail including Einstein coefficients, stimulated emission, spontaneous emission, laser gain, double heterostructures, blue Lasers, optical confinement, laser modes, strained quantum wells lasers which will give insight into the physics of various kinds of semiconductor lasers, in addition to the various processes of luminescence.

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