

Semiconductor Device Physics

2 units

Yasuo Ohno · PROFESSOR / MATERIAL AND DEVICE SCIENCE, ELECTRICAL AND ELECTRONIC ENGINEERING, SYSTEMS INNOVATION ENGINEERING

Target The purpose of this lecture is to understand the background physics which governs the electrical performances of semiconductor devices.

Outline The lecture gives carrier transport theory and equations based on which semiconductor electron devices including various types of transistors, high-field phenomena and short-channel effects in miniaturized transistors and deep levels which are the origin of various malfunctions in semiconductor devices.

Style Lecture and exercise

Keyword device physics, semiconductor device

Fundamental Lecture “Advanced Theory of Electron Devices”(1.0)

Relational Lecture “Photonic Semiconductor Device Physics”(0.5), “Optical and Functional Inorganic Materials”(0.5)

Goal Understand the carrier transport in semiconductors based on the Boltzmann transport equation. 2. Understand the velocity saturation effects and 2-dimensional field distribution effects in miniaturized transistors. 3. Understand the electrical behavior of deep traps in semiconductors based on Shockley-Reed-Hall statistics.

Schedule

1. デバイス物理の基本方程式
2. ボルツマン輸送方程式
3. 電子流と熱流
4. ホットキャリア効果
5. 電子ガスの粘性と MOS 表面電子移動度
6. 短チャネル効果
7. デバイス微細化の限界
8. 大規模高速システムとデバイス特性
9. 深い準位に対する SRH 統計
10. 電子トラップとホールトラップ
11. サイドゲート効果
12. 周波数分散
13. 化合物半導体とシリコンの比較
14. プロセスシミュレーション
15. デバイスシミュレーション
16. テスト

Evaluation Criteria Reports for each theme and examination

Textbook S. M. Sze, Kwok K. Ng, ”Physics of Semiconductor Devices,” 3rd Ed.

Contents <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=185861>

Student Able to be taken by only specified class(es)

Contact

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MAIL

Note This lecture will be given in English.