

Advance Theory of Electrical and Electronic Materials

2 units (selection)

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Target) This course aims to improve the ability to develop new materials by learning the fundamentals of material science and the properties of various electrical and electronic materials.

Outline) Material science of metals, oxide semiconductors, superconductors, magnetic materials, dielectric materials are lectured for the students of electrical and electronic engineering. The fundamentals of these materials are explained at first as basic knowledge. Oxide semiconductors, superconductor, ferroelectric materials, ferromagnetic materials and ferrite are included. Dielectric and magnetic materials are stressed here. General outline of those materials are given at first. After that, magnetization mechanism of ferromagnetics and various properties of dielectrics are discussed mostly at the view-points of both solid state physics and applications. 1. Solid state physics of metals, 2. oxide semiconductors and transparent conductive oxides, 3. superconductors, 4. dielectrics and ferroelectric materials, 5. magnetization of the substance and magnetic domain structure, 6. ferrite and recent magnets, 7. piezoelectric materials and applications, 8. optoelectronics materials such as CCD, laser, and displays.

Style) Lecture and exercise

Keyword) *material science, electrical and electronic engineering, dielectric material, magnetic material, semiconductor materials*

Relational Lecture) “[Advanced Theory of Semiconductors](#)”(0.5), “[Advanced Device Processing](#)”(0.5), “[Advanced Optoelectronic Devices](#)”(0.5)

Goal) Understand the fundamentals in material science for electrical and electronic engineering.

Schedule)

1. Solid state physics of metals
2. Solid state physics of oxide semiconductors
3. Transparent conductive oxide films
4. Physics of superconductor
5. Superconductors and their applications
6. Paradielectric materials
7. Various properties of ferroelectric materials
8. Magnetization of the substance

9. Ferromagnetic materials

10. Ferrite

11. Recent magnets(bond magnets)

12. Piezoelectric materials

13. Application of piezoelectric materials

14. Optoelectronic materials (1)(CCD, laser materials)

15. Optoelectronic materials (2)(display materials)

16. Exercise

Evaluation Criteria) Examination for each theme.

Textbook) 内野研二・石井孝明「強誘電体デバイス」森北出版

Reference)

- ◇ 電気電子材料 塩崎忠 共立出版,森北出版, 高木豊・沢田正三「磁性体・誘電体の物性工学」オーム社, 塩崎忠「圧電材料とその応用」シーエムシー出版
- ◇ 表面科学の基礎と応用, 日本表面科学会編(宮崎栄三代表編集)NTS
- ◇ 超伝導材料, 堂山昌男・山本良一, 東京大学出版会
- ◇ 透明導電膜の技術(改訂2版), 日本学術振興会透明酸化物光・電子材料166委員会編, Ohmsha
- ◇ 薄膜作製応用ハンドブック, 権田俊一監修, エヌ・ティー・エス
- ◇ 電子材料シリーズ フェライト, 平賀貞太郎・奥谷克伸・尾島輝彦, 丸善

Contents) <http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216778>

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

Contact)

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Note) This lecture is carried out by the use of power point. Prepare electronic memory for the study in home.