Optical and Functional Inorganic Materials

2 units (selection)

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Target〉 This cource aims to learn the fundamentals of material science of such as single crystals, polycrystals or amorphous films for optical and functional materials. At the same time, the synthesis methods of various films, their evaluation techniques and the propagating optical beam and acoustic waves in crystals are lectured.

Outline〉 Fundamentals of crystal science is lectured at first. Optical and electronic processes in optical and functional materials such as single crystals, polycrystals or amorphous films are followed. Advanced solid state physics of semiconductors, dielectric and ferroelectric materials are included. Synthesis methods of optical and functional crystals and films, evaluation methods of film properties are also contained. Electro-optical and piezo-electrical effects and solid state physics relating with their effects, characterization of crystals, symmetry elements of crystals and material constants,optical properties of crystals, electro-optical effects and nonlinear effects, piezoelectricity, acoustic waves in crystal,interaction of phtons and phonons in crystal, synthesis methods of thin films (PVD method; electron beam evaporation, MBE, sputtering, laser ablation), film properties (charaterizations of electrical, optical and mechanical properties) are included.

Style〉 Lecture and excercise

Keyword〉 ***functional material, semiconductor device, crystal optics, thin film technology, deposition techniques of thin films***

Relational Lecture〉 "**Photonic Semiconductor Device Physics**"(0.5), "**Nonlinear Optical Devices**"(0.5)

Goal〉 Understanding of the solid state physics of piezoelectric materials and functional thin films

Schedule〉

1. Characterization of crystals
2. Symmetry elements of crystals and material constants 1
3. Symmetry elements of crystals and material constants 2
4. Optical properties of crystals 1
5. Optical properties of crystals 2
6. Electro-optical effects and nonlinear effects 1
7. Electro-optical effects and nonlinear effects 2
8. Piezoelectricity 1
9. Piezoelectricity 2
10. Acoustic waves in crystal 1
11. Acoustic waves in crystal 2
12. Interaction of phtons and phonons in crystal
13. Synthesis methods of thin films 1(PVD method; electron beam evaporation, MBE, sputtering, laser ablation)
14. Synthesis methods of thin films 2(PVD method; electron beam evaporation, MBE, sputtering, laser ablation)
15. Film properties (Charaterizations of electrical, optical and mechanical properties)
16. Exercise

Evaluation Criteria〉 Reports for each theme and examination

Textbook〉 Tomoya Ogawa:Fundamentals in Crystal Engineering, Shoukabou (in Japanese) and Shunichi Gonda, Applied Handbook of Thin Film Depositions, (NTS)(in Japanese)

Reference〉

- ◇ 荒川剛他，無機材料化学，三共出版
- ◇ 日本学術振興会透明酸化物光・電子材料第 166 委員会編，透明導電膜の技術 (改訂 2 版)，Ohmsha

Contents〉 http://cms.db.tokushima-u.ac.jp/cgi-bin/toURL?EID=216896

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

Contact〉

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Note〉 This lecture will be given in English.