Advanced crystal physics　結晶物理学特論

About the course

ID	M 572 (P121040001), Division of Materials Science and Engineering, Master program of the Graduate School of Engineering
Time	Second semester, 9h00 – 10h30 on Mondays
Place	Bldg B5, Room 1B-39
More info	http://www.engm.mtr.osakafu-u.ac.jp/pers_numakura/teaching-en.html

Instructor

NUMAKURA Hiroshi, Professor
Contact　E-mail: numakura@mtr.osakafu-u.ac.jp, telephone: 072-254-9310
Office hours　Thursdays 16h15 - 17h45, Bldg B5, Room 3A-01

Objective

Solid crystals are useful in electronics, optics, acoustics, and many other arena. This course aims at understanding underlying principles of physics and chemistry of crystalline solids, covering a variety of topics, and illustrating engineering applications of materials.

Textbook

Robert E. Newnham: *Properties of materials – anisotropy, symmetry, structure* (Oxford University Press, 2005).

Study-aids

J. F. Nye: *Physical properties of crystals: their representation by tensors and matrices* (Oxford University Press, 1957).

Gerald Burns: Introduction to group theory with applications (Academic Press, 1977). 邦訳 G. バーンズ（著），中村輝太郎・沢田昭勝（訳）「物性物理学のための群論入門」（培風館, 1983）.

小野寺 嘉孝:「物性物理/物性化学のための群論入門」（裳華房, 1996）.

小川 智哉: 応用物理学選書「結晶工学の基礎」（裳華房, 1998）.

今野 豊彦: 「物質の対称性と群論」（共立出版, 2001）.

Related courses

Advanced characterization of crystal structures （結晶構造評価特論）

Advanced solid-state theory in materials （材料物性学特論）

Course plan

In the first few classes mathematical and physical background materials are given. Specific topics that are discussed after that are chosen from the textbook on the basis of students' preferences. Exercises for homework will be given occasionally, and students are to submit the report it in a week. The teacher may ask some of the students to present the answer at the

beginning of the next class.

Evaluation

Classroom discussions and homework reports

Schedule

#	*Date*	*Details*
1	Mon 29 Sep	Introduction (Ch 1)
2	Mon 6 Oct	Transformations and symmetry (Ch 2 & 3)
3	Mon 20 Oct	Transformation and symmetry (Ch 3 & 4)
4	Mon 27 Oct	Tensors and physical properties (Ch 5)
5	Thu 6 Nov	Thermodynamic relationships (Ch 6)
6	Mon 10 Nov	*Specific heat and entropy (Ch 7)*
7	Mon 17 Nov	*Dielectric constant (Ch 9)*
8	Wed 26 Nov	*Stress and strain (Ch 10)* *Thermal expansion (Ch 11)*
9	Mon 1 Dec	*Piezoelectricity (Ch 12)* *Elasticity (Ch 13)*
10	Mon 8 Dec	*Magnetic phenomena (Ch 14)*
11	Mon 15 Dec	*Ferroic crystals (Ch 16)*
12	Mon 22 Dec	*Electrical resistivity (Ch 17)*
13	Thu 15 Jan	*Thermal conductivity (Ch 18)*
14	Mon 19 Jan	*Diffusion and ionic conductivity (Ch 19)*
15	Mon 26 Jan	*Thermoelectricity (Ch 21)*
16	Mon 2 Feb	(End-of-term exam)