Hokkaido University Syllabus					
Course Title					
Applied Materials Chemistry A (Solid State Chemistry of Functional Materials)					
Subtitle					
Instructor (Institution)					
Toshihiro SHIMADA (Faculty of Engineering)					
Other Instructors (Institution)					
Toshihiro SHIMADA (Faculty of Engineering) Taro NAGAHAMA (Faculty of Engineering)					
Course Type				Open To Other Faculties / Schools	OK
Year	2018	Semester	2nd Semester	Course Number	094211
Type of Class	Lecture	Number of Credits	2	Year of Eligible Students	～
Eligible Department / Class				Other Information	
Numbering Code	CHEM_ELMAT 6142				
Major Category Code	Major Category Title				
CHEM_ELMAT	Chemical Sciences and Engineering_Elective Course for Materials Chemistry				
Level Code	Level				
6	Specialized Subjects (advanced) in graduate level (Master's Course and Professional Course)				
Middle Category Code	Middle Category Title				
1					
Small Category Code	Small Category Title				
4					
Language Type					
Classes are in Japanese and English (bilingual, or language is decided once the student composition has been finalized).					

Key Words

First part (3rd semester):
-Interface, thin film, crystal growth, nanojunction, spintronics, magnetism, electronic devices -
Second part (4th semester):
-Structure and functions of solid state materials -
-Ligand field theory, semiconductors, solar cells, lasers, non-linear optics, phase transition kinetics, electron correlation, ultra hard ceramics, plasmonics, superconductivity etc.

Course Objectives

First part (3rd semester):
Study the electronic and magnetic properties of thin films and nanostructured materials. Several fabrication methods, i.e. MBE, sputtering, PLD are introduced. The relation between the function of the nano-materials and electronic states and magnetism will be explained.
Second part (4th semester)
Study the relationship between the structure and function of solid state materials.
Obtain deep insights in the atomic scale about the chemistry and physics behind the practical technologies, such as magnet, solar cells, lasers, thermal camera and CD-R/W.

Course Goals

First part (3rd semester):
Learn the electronic states in the solid state materials; band structure and magnetic interactions. Understand the development of the new functional devices and fabrication process.
Second part (4th semester):
The goal is to understand the "heart" of chemistry and physics of solid state functional materials and obtain the ability to design and crate new materials. The lecture and the homeworks will be organized to achieve this goal.

Course Schedule

First part (3rd semester):
1. outline of the nanostructured materials and thin films
2-4 electronic states in solid; band theory.
5-6 magnetic properties of solid
7 fabrication process of nan-structure and thin films
8 development of the devices: spintronics

Second part (4th semester):
Topics other than the list can also be lectured according to request.
1. Introduction to solid state chemistry / physics and thermoelectricity
2. semiconductors focused on solar cells
3. transparent conductors (oxides, nanowires, graphene)
4. advanced ligand field theory and basics of photophysics - lasers,
nonlinear optics, optical fibers
5. interfaces: workfunction and chemistry of semiconductor junction devices
6. phase memory materials (DVD-R/W, shape memory alloys)
7. ferroelectrics and shape memory alloy
8. thermography and strongly correlated electron systems

Homework

Preparation: read the handout posted on the website (URL will be given at the first lecture).
Review: solve the problem given in the lecture and write brief reports.

Grading System

Grading is based on the quiz given at each lecture and the final report.

Textbooks

Reading List

Inorganic chemistry / D.F. Shriver and P.W. Atkins : Oxford University Press, 2006, ISBN:0199264635
上記は購入する必要はない。配布プリントを使用する。 No need to purchase the book. We use handouts.

Websites

Website of Laboratory

www.eng.hokudai.ac.jp/labo/kotai

Additional Information

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