

Lecture Syllabus

Course title: Topics in Magnetic Materials

Course Number: 445.639 (001), **Credits:** 3

Instructor: Prof. Sang-Im Yoo (Rm 33-208, siyoo@snu.ac.kr, Tel : 880-5720)

Prerequisite: Physical Chemistry of Materials,
Electric, Magnetic and Optical Properties of Materials

Class time & room: Tue, Thu – 09:30 ~ 11:00, Rm 33-328

Teaching Assistant: KangHyuk Lee (Rm 131-211, not123@snu.ac.kr, Tel : 880-7443)

Homepage: <http://emdl.snu.ac.kr>

Office hours: Mon, Wed – 15:30 - 16:30

Course Objective

The objective of this lecture is to provide offer the magnetic concepts and their applications, which are essential for understanding processing and magnetic property, to the graduate student of the department of materials science and engineering. On the basis of these concepts, students will try to understand the types of magnetism, magnetic anisotropy, magnetoelastic effects, domains, magnetization and magnetic materials.

Text & References: Robert C. O'Handley, "Modern Magnetic Materials", John Wiley & Sons, Inc. (2000)

David Jiles, "Introduction to Magnetism and Magnetic Materials", Chapman & Hall, 2nd edition (1998)

B.D. Cullity, "Introduction to Magnetic Materials", 2nd edition (2009)

J.M.D. Coey, "Magnetism and Magnetic Materials", Cambridge University Press (2009)

Charles Kittel, "Introduction to Solid state Physics", Chap. 11-12, 8th edition, John Wiley & Sons, Inc.

Many related journal papers

Grading: Midterm exam (20%)

Final exam (30%)

Homework (50%)

(Home problems 20% + Presentations 20% + Term paper 10%)

(# absence more than 4 lectures = F)

Lecture Contents

I . Basic Magnetic Quantities & Units

- (1) Magnetic Field and magnetic Induction
- (2) Magnetic Moment & Magnetization
- (3) Magnetization curve & Magnetic Hysteresis Curve

II . Types of Magnetism

- (1) Diamagnetism
- (2) Paramagnetism
- (3) Ferromagnetism
- (4) Antiferromagnetism
- (5) Ferrimagnetism

III. Mgnetic Anisotropy & Magnetoelastic Effects

- (1) Magnetic Anisotropy
- (2) Magnetoelastic Effects

IV. Magnetic Domain Walls, Domains & Magnetization Process

- (1) Magnetic Domain Walls
- (2) Magnetic Domains
- (3) Magnetization Process

-----Mid-term Exam -----

V. Soft & Hard Magnetic Materials

- (1) Soft Magnetic Materials
- (2) Hard Magnetic Materials

VI. Magnetism in Small Structures

- (1) Exchange Coupling
- (2) Nanostructured Magnetic Materials

VII. Electronic Transport in Magnetic Materials

- (1) Magnetoresistance in Nonmagnetic Materials
- (2) Magnetoresistance in Ferromagnetic Materials
- (3) Giant Magnetoresistance(GMR) & Colossal Magnetoresistance (CMR)

VIII. Magnetic Recording

- (1) Magnetic Recording Overview
- (2) Recording Media
- (3) Recording Heads
- (4) Magnetic Random Access Memories (MRAM)

----- Final Exam -----