

University of Southern California
Department of Materials Science and Engineering

MASC 505

Crystals and Anisotropy
Course Syllabus
Fall 2014

E. Goo

Edward Goo

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Phone: 213 740-4426 I do check my voice mail very often so this is not the best method for contacting me for a quick response.

E-mail: ekgoo@usc.edu e-mail is the preferred method of communication. Please put "MASC 505" in the subject of the e-mail or I may mistake it for junk e-mail. It is also best to use your USC e-mail account to send e-mail to me since I will read all e-mails from an USC account. Request for confidential information such as grades must be from USC account.

Office Hours: Monday 3:30-4:30 pm and Wednesday 9:30-10:30 am by appointment. It is required that you e-mail me to make an appointment even if you are coming during office hours. If these times do not work for you send me an e-mail to arrange a meeting.

Class Website: Log on to Blackboard at <https://blackboard.usc.edu>

Lectures: MW 2:00-3:15 pm. Location KAP 156. There will be no lecture on Monday September 1st, Monday, October 6th, Monday November 24th, Wednesday November 26th, and Friday November 28th.

I. Formal Crystallography - method for classifying crystals based on their symmetry

A. Symmetry Elements

- i. Mirror plane
- ii. Rotation axis
- iii. Inversion point

B. Combination of Symmetry Elements – Euler's Rule

C. Point Groups

D. Space Groups

II. Physical Properties of Crystals - effect of symmetry on the physical properties of crystals

A. 1st Order Tensors

- i. Polar vectors
- ii. Axial vectors
- iii. Coordinate transformations

B. 2nd Order Tensors

- i. Resistivity
- ii. Coordinate transformations
- iii. Stress and strain
- iv. Suffix notation

C. Third Order Tensors

D. Fourth Order Tensors

- i. Elasticity
- ii. Reduced notation

E. Average properties of polycrystal

III. Diffraction Theory

A. Vector Geometry of Non-cartesian Vectors

B. Laue Equations

C. Bragg's Law

D. Structure Factor

E. Effect of Symmetry Elements on Diffraction Pattern

F. How to Read the International Tables of X-ray Crystallography

G. Polarization Factor and Lorentz Factor(optional)

F. Fourier Approach(optional)

IV. X-ray Diffraction Methods

A. X-ray Sources, X-ray Detectors and X-ray Safety

B. Laue Method

C. X-ray Diffractometer

- D. Rotation Method
- E. Fourier Series Methods
- F. Noncrystalline Solids

Grading

Homework	10% credit/no credit
Three midterms	90%(30% each)(There will be no final)

Midterm I September 24, 2014 Wednesday 2:00 - 3:15 pm

Midterm II October 29, 2014 Wednesday 2:00 - 3:15 pm

Midterm III December 3, 2014 Wednesday 2:00 – 3:15 pm

All midterms are held in class.

Text Covering the Material in MASC 505

None of these texts are required. They provide an alternative source for the material covered in the course.

1. Buerger, M., "Elementary Crystallography" – on reserve in Seaver Science Library QD905.B96 1963
2. Nye, J. F., "Physical Properties of Crystals" - recommended text - on reserve in Seaver Science Library QD931.N9 1967
3. Warren, B. E., "X-ray Diffraction" – recommended text - on reserve in Seaver Science Library QD945.W33
4. Kelly, A and Groves, G., "Crystallography and Crystal Defects" – optional text

Statement for Students with Disabilities

Any student requesting academic accommodations based on a disability is required to register with Disability Services and Programs (DSP) each semester. A letter of verification for approved accommodations can be obtained from DSP. Please be sure the letter is delivered to me (or to TA) as early in the semester as possible. DSP is located in STU 301 and is open 8:30 a.m.–5:00 p.m., Monday through Friday. Website and contact information for DSP:
http://sait.usc.edu/academicsupport/centerprograms/dsp/home_index.html, (213) 740-0776 (Phone), (213) 740-6948 (TDD only), (213) 740-8216 (FAX) ability@usc.edu.

Any accommodation request must be made at least two weeks prior to the date of the accommodation. The accommodation request must contain all the relevant information such as date and time when the request is made.

Statement on Academic Integrity

USC seeks to maintain an optimal learning environment. General principles of academic honesty include the concept of respect for the intellectual property of others, the expectation that individual work will be submitted unless otherwise allowed by an instructor, and the obligations both to protect one's own academic work from misuse by others as well as to avoid using another's work as one's own. All students are expected to understand and abide by these principles. SCampus, the Student Guidebook, (www.usc.edu/scampus or <http://scampus.usc.edu>) contains the University Student Conduct Code (see University Governance, Section 11.00), while the recommended sanctions are located in Appendix A.

Emergency Preparedness/Course Continuity in a Crisis

In case of a declared emergency if travel to campus is not feasible, USC executive leadership will announce an electronic way for instructors to teach students in their residence halls or homes using a combination of Blackboard, teleconferencing, and other technologies.