

University of Southern California
Department of Materials Science and Engineering

MASC 505

Crystals and Anisotropy

E. Goo

Course Syllabus

Fall 2010

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E-mail ekgoo@usc.edu please put "MASC 505" in the subject or I may mistake it for junk email. Best to use your USC e-mail account

Office Hours: Wednesday 1:00-2:00 pm and 3:15-4:15 pm by appointment

Class Website Log on to Blackboard at blackboard.usc.edu

Lectures MW 2:00 pm to 3:15 pm No lecture on November 24, 2010 Location VHE 210

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(optional)
- F. Noncrystalline Solids(optional)

Grading

Homework	10% credit/no credit
Three midterms	90%(30% each)

Midterm I September 22, 2010

Midterm II October 27, 2010

Midterm III December 1, 2010

All midterms are on a Wednesday and held during lecture time.

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" - text in the Bookstore(\$89.50 new) and on reserve in Seaver Science Library QD931.N9 1967
3. Warren, B. E., "X-ray Diffraction" - text in the Bookstore(\$16.95 new) and on reserve in Seaver Science Library QD945.W33
4. Kelly, A and Groves, G., "Crystallography and Crystal Defects" – optional text(\$70.00 new) in the bookstore