University of Southern California

Department of Materials Science and Engineering

MASC 505 Crystals and Anisotropy E. Goo

Course Syllabus

Fall 2007

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Office Hours: Monday 2:15 - 4:15 pm or by appointment

Class Website Log on to Blackboard at www.den.usc.edu

Lectures MWF 1:00 pm to 1:50 pm No lecture on November 21, 2007 Location OHE 120

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	25% credit/no credit
Three midterms	75%(25% each)

Midterm I October 5, 2007
Midterm II November 9, 2007
Midterm III December 7, 2007

All midterms are on a Friday 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

Clickers – Clicker will be distributed at the beginning of the semester and are to be returned at the end of the semester. Students are responsible for bringing the clickers to class everyday and if lost the student will have to purchase a replacement for $31 from the bookstore.