

Materials Science 150

Special Topic on Diffraction Techniques in Materials Science
Spring Quarter 2017

Class Meetings: Tue. and Thur. 10:30, Keck 111

Lab Sessions: Wed, 1 - 4 pm, Steele 339

Text:

"Space Groups for Solid State Scientists," By M. Glazer and G. Burns, Academic Press.

"Fundamentals of Powder Diffraction and Structural Characterization of Materials, 2nd ed." By V.K. Pecharsky and P.Y. Zavalij, Springer [2009]

Reserved Texts: (in SFL)

"Modern Powder Diffraction" edited by D.L. Bish and J.E. Post, Washington, D.C., Mineralogical Society of America [1989]

"Elements of X-ray crystallography" by Leonid V. Azároff, New York, McGraw-Hill [1968]

"X-ray diffraction procedures for polycrystalline and amorphous materials" by Harold P. Klug and Leroy E. Alexander, 2nd ed, New York, Wiley [1974]

"Elements of X-ray Diffraction" 2nd ed., by B.D. Cullity, Reading, MA, Addison-Wesley [1978]

"The Rietveld Method" edited by R. A. Young, International Union of Crystallography,

Course Structure (2:3:4):

Data analysis/Lab reports/Homework: weekly, 100%

No Midterm

No Final

Course Content:

Applications of X-ray and electron backscatter diffraction methods to the structural characterization of materials. Emphasis is on the analysis of polycrystalline materials but some discussion of single crystal methods is also presented.

Techniques include quantitative phase analysis, crystallite size measurement, lattice parameter refinement, internal stress measurement, quantification of preferred orientation (texture) in materials, Rietveld refinement, and determination of structural features from small angle scattering. Homework assignments will consist of analyses of diffraction data, and students are to prepare formal laboratory write-ups. Samples of interest to students for their thesis research may be examined where appropriate.

Lectures will cover:

Symmetry, Point and Space Groups and the International (and Schoenflies)
Nature, Production and Detection of X-rays
Shapes of Powder Diffraction Peaks
The Rietveld Method
The Pair Distribution Function
Small Angle Scattering
K-line Backscatter Analysis

Labs and Assignments will tentatively cover:

Lattice Parameter Refinement
Ab initio Indexing
Quantitative Analysis
Particle/Grain Size Analysis
Rietveld Refinement and Profile Function Analysis
SEM Electron Backscatter Analysis

Personnel:

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