

ME 504 X-RAY DIFFRACTION AND ELECTRON MICROSCOPY

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CATALOG DATA :

504-3 X-Ray Diffraction and Electron Microscopy. (Same as PHYS 571)

X-ray physics. Geometry of crystals. Scattering of X-ray by atoms, crystals and noncrystalline matter. Kinematical theory of diffraction. Powder method, Laue method. Electron optics. Formation and analysis of diffraction patterns. Imaging techniques. Image contrast theories. Analysis of crystal defects. Advanced analytical electron microscopes.

COURSE OUTLINE:

Topics	% time
1. Introduction	2
2. X-ray Physics	8
- x-ray tubes	
- white radiation	
- characteristic radiation	
- absorption	
3. Geometry of Crystals	12
- unit cells, crystal structure	
- reciprocal lattice and applications, Ewald sphere concept	
- stereographic projection	
4. Scattering of X-rays	14
- electromagnetic background	
- Thompson scattering	
- polarization	
- compton effect	
- atomic scattering factor	
- structure factor	
5. Kinematical Theory of Diffraction	24
- intensity of diffracted beams	
- factors influencing intensity	
6. Powder Method	12
- Debye-Scherrer camera	
- focusing camera	
- back-reflection focusing camera	

- crystal structure analysis	
- precise lattice parameter measurement	
7. Laue Method	12
- back-reflection method	
- transmission method	
- orientation determination	
- rotation of crystals	
8. Electron Optics	5
- basic construction of electron microscope	
- magnetic lens and resolution	
- relation between image and diffraction	
9. Formation and Analysis of Diffraction Pattern	8
- back focal plane	
- image plane	
- diffraction methods	
- indexing of diffraction pattern	
10 Imaging Techniques	7
- bright-field image	
- dark-field image	
- weak beam image	
- high resolution lattice image	

LABS:

1. Determination of source x-ray spectrum
2. Powder method of known specimen
3. Powder method of unknown specimen
4. Intensity calculation of diffraction peaks

TEXTBOOK:

1. B. D. Cullity, Element of X-ray Diffraction, ADDISON-Wesley, 2nd edition
2. L. V. Azroff, Elements of X-ray Crystallography, McGraw-Hill

Grading Policy:

Exams:	1. beginning to Structure Factor	30%
	2. Structure Factor to EM	40%
Labs:		20%
Homework:		10%
Total		100%

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