MT241 Aug 3:0

Structure and Characterization of Materials

Instructor

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Department: Materials Engineering

Course Time: Mon., Wed., Fri. 10-11 AM

Lecture venue: Lecture Hall

Detailed Course Page:

Announcements

Brief description of the course

This is a very basic foundational course. Anybody interested in Materials Science, irrespective of the background (Physics, Chemistry, Metallurgy, Chemical Engineering, Mechnical Engineering, etc., can take this course. The course starts with the fundamental concepts to understand crystal structures such as lattice, point and space group symmetries.It also covers point defects and some relevant properties to some extent.

The characterization part of the course delves into the details of x-ray diffraction (both theory and experiment). Emphasis is laid on understanding Bragg's law from reciprocal lattice perspective, i.e. Ewald construction. The various factor contributing to the intensity and the shape of Bragg peaks are discussed. A comparison between x-ray, neutron and electron diffraction is briefly discussed to make the student appreciate the complementarity of the three techniques. More focus is given to x-ray powder diffraction by emphasizing on the different ways to generate x-rays ray optics of diffractometers such as Debye Scherrer and Bragg Brentanno geometry. The course then deals with practical applications of x-ray diffraction (crystallite size estimation, residual stress analysis, etc.). Towards the end the course deals with scanning and transmission

electron microscopy.

Prerequisites

Some understanding of simple maths (high school level) such as vectors, geometric progression, is desired.

Syllabus

Basics of Crystallography (Lattice, Point group symmetry, Stereographic projection, Space group); Reciprocal lattice; Crystal structure; Point defects; Diffraction; Scanning electron microscopy (SEM) ; Transmission electron microscopy (TEM).

Course outcomes

Students will learn about fundamentals of crystallography, describe structures from symmetry viewpoint, formal description of point defects and its importance in influencing properties, interpretation of x-ray powder diffraction pattern to obtain structural and microstructural information, essentials about SEM and TEM.

Grading policy

3 class tests (~ 50 %) and final examination (~ 50 %)

Assignments

Assignments (mostly problems) are given for every theme covered in the class. These assignments are meant to help students grasp the concepts in detail.

Resources

The lecture notes (in pdf) are distributed in advance to the students.