



MS414: Materials Characterization

Class Time Mon, Tue, Wed, Thurs, 2 – 5 pm

Location To be announced

Credit 3

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Required Materials There is no dedicated textbook in this course. A lecture note and reading materials (mostly selected chapters from references) will be given out prior to each lecture.

Course Summary

★ Description

Modern advances in materials science and engineering owe a lot to the growing capabilities of various characterization techniques. In this course, we will cover some of commonly used characterization techniques in materials science—what are the basic operational principles of them, what types of information can they provide, how are they practically instrumented, and how are they applied to real-world materials research. After the completion of the course, students should be able to tell which characterization techniques to use in order solve a given materials problem. The target audiences of the course are undergraduate juniors and seniors, as well as first-year graduate students.

★ Course Outline

1. Overview of various characterization techniques
2. Chemical analysis techniques
 - 2.1. X-ray Photoelectron Spectroscopy (XPS)
 - 2.2. Ultraviolet Photoelectron Spectroscopy (UPS)
 - 2.3. Auger Electron Spectroscopy (AES)
 - 2.4. X-ray Fluorescence (XRF)
3. Ion beam based techniques
 - 3.1. Secondary Ion Mass Spectrometry (SIMS)
 - 3.2. Rutherford Backscattering Spectrometry (RBS)
4. Diffraction techniques
 - 4.1. Basic diffraction theory
 - 4.2. X-ray Diffraction (XRD)
5. Summary: Examples of real materials characterization

Course Evaluation

Grading

Mid-term exam	35%
Final exam	35%
Final presentation*	30%

* Each presentation will be prepared and given by a team consisting of 1 – 4 students; Presentation topics must be on a characterization technique not covered during the course, such as FTIR, Raman Spectroscopy, ICP, PIXE, PEEM, EELS, EXAFS, and etc.