Vm565
Structural, Physical and Chemical Characterization of Materials
Fall 2017
University of Michigan-Shanghai Jiao Tong University Joint Institute

Instructor: Qianli Chen
qianli.chen@sjtu.edu.cn,
Phone: 34206765 ext. 2171
Office: JI building 217
Office Hours: Thursday 13:00 – 14:30

Lectures: Tuesday & Thursday 10:00 – 11:40, CRQ305

Books: Yang Leng, "Materials characterization: introduction to microscopic and spectroscopic methods"

Course topics: Study of the basic structural, physical and chemical characterization techniques that are commonly used in materials science and engineering. X-ray diffraction, a wide range of microscopies, spectroscopies, and scanning probe methods will be covered. Lectures will be integrated with practical data analysis tutorials where the analytical methods will be demonstrated and/or used by the student to study a material. Techniques will be presented in terms of the underlying physics and chemistry.

Homework: Homework will be assigned to help learning. You are expected to read books, course materials, and discuss actively with each other to solve the problems, but you should hand in your unique version.

Exam: There will be one midterm and one final exam.

Project: You are required to use one or several characterization methods to study one material of your interest. More details will be announced during the class. You will give a presentations of 20 minutes + 5 minutes Q&A. You are required to submit a report about the same topic. The report should reflect your intelligent reading of current literatures.

Grading: Homework 30%
Project 30%
Midterm exam 20%
Final Exam 20%

Honor code refresh: All students in the class are presumed to be bound by the Honor Code of the Joint Institute. Any violation of the honor polices will be

reported to the Honor Council, and if guilt is established penalties may be imposed.

Lecture Schedule

(subject to change)

Date	Topic
9/12	Introduction
9/14	Crystal Structure, Reciprocal Space
9/19	Diffraction
9/21	*XRD phase analysis
9/26	*XRD structure refinement
9/28	Electron Microscopy
10/10	*Microscope Image Analysis
10/12	Transmission Electron Microscopy (TEM)
10/17	Scanning Tunneling Microscopy (STM)
10/19	Atomic Force Microscopy (AFM)
10/24	*SPM data analysis
10/26	Thin Films
10/31	Midterm Review
11/2	Midterm Exam
11/7	Electrical Conductivity
11/9	Semiconductors
11/14	Optical Properties
11/16	X-ray Spectroscopy for Elemental Analysis
11/21	X-ray Photoelectron Spectroscopy (XPS)
11/23	*XPS peak analysis
11/28	Ultraviolet Photoelectron Spectroscopy (UPS)
11/30	Kelvin Probe Force Microscopy (KPFM)
12/5	Vibrational Spectroscopy (FTIR, Raman)
12/7	Final Review
12/12	No class
12/14	Final Exam

*Tutorials: practical data analysis session