

课程大纲

COURSE SYLLABUS

1.	课程代码/名称 Course Code/Title	MSE5018/先进材料表征技术																				
2.	课程性质 Compulsory/Elective	专业课																				
3.	课程学分/学时 Course Credit/Hours	3 学分/48 学时																				
4.	授课语言 Teaching Language	英文																				
5.	授课教师 Instructor(s)	任富增/于严溟																				
6.	是否面向本科生开放 Open to undergraduates or not	是																				
7.	先修要求 Pre-requisites	本科生需修过：MSE001 《Fundamentals of Materials Science and Engineering》、MSE203 《Crystallography》两门课程。 研究生：无																				
8.	教学目标 Course Objectives	<p>This course is to introduce the fundamental theoretical framework for diffraction, spectroscopy and imaging methods used in the microstructure, composition and surface characterization of engineering materials. The aim is to enable students to master the characterization methods for material science, to understand the theory, basic structure and working principle of a variety of analytical instruments.</p>																				
9.	教学方法 Teaching Methods	<p>本课程以理论与实践结合为主要特点，针对 XRD, SEM, TEM, XPS, AES, SPM(AFM & STM), FIB, and Thermal Analysis 等在材料科学研究中常用的分析表征技术进行讲解及讨论。</p> <p>本课程不仅包括对这些技术的原理及操作流程的理论讲解，亦重视与具体实践应用相结合，以确保学生可以学习完此课程后即可解决材料科学与工程相关研究中遇到的实际问题。</p>																				
10.	教学内容 Course Contents	<table border="1" style="width: 100%; border-collapse: collapse;"> <tr> <td style="width: 30%;">Section 1</td> <td>Week 1-2 X-ray Diffraction (XRD): Basics, Quantitative Analysis and Structure Refinement</td> </tr> <tr> <td>Section 2</td> <td>Week 3 Secondary Electron Microscopy (SEM)</td> </tr> <tr> <td>Section 3</td> <td>Week 4 Transmission Electron Microscopy (TEM): Basics</td> </tr> <tr> <td>Section 4</td> <td>Week 5 Transmission Electron Microscopy (TEM): Diffraction</td> </tr> <tr> <td>Section 5</td> <td>Week 6 Transmission Electron Microscopy (TEM): Imaging</td> </tr> <tr> <td>Section 6</td> <td>Week 7 X-ray photoelectron spectroscopy (XPS)</td> </tr> <tr> <td>Section 7</td> <td>Week 8 Auger Electron Spectroscopy (AES)</td> </tr> <tr> <td>Section 8</td> <td>Week 9 Infrared Spectroscopy</td> </tr> <tr> <td>Section 9</td> <td>Week 10-11 Mechanical Testing at small scales (FIB and Nanoindentation)</td> </tr> <tr> <td>Section 10</td> <td>Week 12 Scanning Probe Microscopy (SPM): Scanning Tunneling microscopy (STM)</td> </tr> </table>	Section 1	Week 1-2 X-ray Diffraction (XRD): Basics, Quantitative Analysis and Structure Refinement	Section 2	Week 3 Secondary Electron Microscopy (SEM)	Section 3	Week 4 Transmission Electron Microscopy (TEM): Basics	Section 4	Week 5 Transmission Electron Microscopy (TEM): Diffraction	Section 5	Week 6 Transmission Electron Microscopy (TEM): Imaging	Section 6	Week 7 X-ray photoelectron spectroscopy (XPS)	Section 7	Week 8 Auger Electron Spectroscopy (AES)	Section 8	Week 9 Infrared Spectroscopy	Section 9	Week 10-11 Mechanical Testing at small scales (FIB and Nanoindentation)	Section 10	Week 12 Scanning Probe Microscopy (SPM): Scanning Tunneling microscopy (STM)
Section 1	Week 1-2 X-ray Diffraction (XRD): Basics, Quantitative Analysis and Structure Refinement																					
Section 2	Week 3 Secondary Electron Microscopy (SEM)																					
Section 3	Week 4 Transmission Electron Microscopy (TEM): Basics																					
Section 4	Week 5 Transmission Electron Microscopy (TEM): Diffraction																					
Section 5	Week 6 Transmission Electron Microscopy (TEM): Imaging																					
Section 6	Week 7 X-ray photoelectron spectroscopy (XPS)																					
Section 7	Week 8 Auger Electron Spectroscopy (AES)																					
Section 8	Week 9 Infrared Spectroscopy																					
Section 9	Week 10-11 Mechanical Testing at small scales (FIB and Nanoindentation)																					
Section 10	Week 12 Scanning Probe Microscopy (SPM): Scanning Tunneling microscopy (STM)																					

	Section 11 Week 13-14 Scanning Probe Microscopy (SPM): Atomic Force Microscopy (AFM)
	Section 12 Week 15 Thermal Analysis (TGA, DTA and DSC)
	Section 13 Week 16 Fluorescence and Confocal Microscopy
11. 课程考核 Course Assessment	
	(①考核形式 Form of examination; ②分数构成 grading policy; ③ 如面向本科生开放, 请注明区分内容。 If the course is open to undergraduates, please indicate the difference.) Attendance 10% + Homework 20% + In class quiz 15% + Mid-term Exam 30% + Final Presentation 25%
12. 教材及其它参考资料 Textbook and Supplementary Readings	
	Yang Leng. Materials Characterization: Introduction to Microscopic and Spectroscopic Methods, 2nd Edition. ISBN: 978-3-527-33463-6; David B. Williams, C. Barry Carter. Transmission Electron Microscopy: A Textbook for Materials Science. ISBN: 038776500