

教學大綱(Syllabus)-大學部

系務會議通過修訂日期：2007/9/12

updated: 2007/10/16

課程編碼 (course no.)	N94005			學分 (credits)	3
課程名稱 (course name)	(中) 繞射原理				
	(Eng.) Diffraction Theory				
開課系所班級 (dept. & year)	材料科學與工程學系碩專班 (Dept. of Mat. Sci. & Engr., Master-Professional Program)			授課教師 (teacher)	曾文甲教授 (Prof. Wenjea J. Tseng)
課程類別 (course type)	選修 (Elective Course)	授課語言 (language)	中文 (Chinese)	開課學期 (semester)	上學期 (Fall)
課程簡述 (course description)	(中) 工業材料的技術發展有賴於對材料微結構的了解，X 光繞射儀已是從事材料研究工作者不可或缺的工具之一。本課程將針對 X 光繞射之原理、分析儀器的構造及將 X 光繞射應用於材料分析的實例做深入的介紹，佐以實際案例(Case Study)說明，期能使同學對其理論與實務有一基礎的認識。				
	(Eng.) Understanding materials microstructure is critically important to the development of engineering materials. In this regard, x-ray diffraction (XRD) has become one of the most important tools in characterizing the materials structure. This course aims to provide students the fundamental theories of XRD, the instrumental details and their designed functions, and practices of using XRD in materials characterization. In particular, the class will be implemented with assistance of many case studies as examples to help students gain insights toward using XRD in structural analysis.				
課程目標 (course objectives)	(中) 熟悉基礎 X 光繞射原理於材料的結構分析				
	(Eng.) Fundamental understanding of x-ray diffraction theories to materials structural characterization.				
先修課程(prerequisites)					
課程編碼 (course no.)	課程名稱 (course name)	與課程銜接的重要概念、原理與技能 (relation to the current course)			
	材料科學導論	結晶學			

教學模式 (teaching methodology)	模式 (methodology)	講授 (teaching)	討論/報告 (discussion & report)	實驗/參訪 (exp./fab visit)	遠距/網路教學 (remote/web teaching)	合計 (sum)
	學分分配 (credit distrib.)	3				3
	授課時數分配 (hour distrib.)	3				3

授課進度與內容 (週次、單元名稱與內容、習作/考試進度、備註) (course content and homework/tests schedule)			
週次 (week)	單元名稱與內容 (subject and content)	習作/考試進度 (homework and tests)	備註 (remark)
01	Introduction: History of X-Ray The continuous and characteristic spectrum		
02	Filters Production of X-ray Detection of X-ray	Homework 1	
03	Crystal lattices Miller Indices and Reciprocal Lattices		
04	Crystal Systems Symmetry Operation and Point Groups	Homework 2	
05	Bragg's Law Diffraction Methods		
06	Scattering Theories Structural Factor Calculations (1)	Homework 3	
07	Structural Factor Calculations (2)	<i>Quiz 1</i>	
08	Other Factors that may contribute to diffraction intensity		
09	Diffraction from real samples: crystallite size, residual strains, amorphous samples	Homework 4	
10	Diffraction (1)		
11	Diffraction (2)		
12	Phase identification: methods and practices	<i>Quiz 2</i>	
13	Phase identification: lab demonstration	Homework 5	
14	Determination of crystal structure		
15	Precise parameter measurements		
16	Structure of polycrystalline aggregates		
17	Stress measurement		
18	Concluding remarks	<i>Final exam</i>	
學習評量方式 (evaluation)			
<div style="text-align: right; margin-right: 20px;"> Quizzes (2) 50% Final Exam 30% Homeworks 10% (Homeworks will be given after finishing each chapter.) Class Attendance 10% </div>			
教科書 (書名、作者、書局、代理商、說明) (textbook)			



Elements of X-ray diffraction, B. D. Cullity and S. R. Stock, Prentice Hall.

**參考書目 (書名、作者、書局、代理商、說明
(other references)**

X-光繞射原理與材料結構分析，吳泰伯、許樹恩，民全書局，1994。

Introduction to x-ray powder diffractometry, R. Jenkins and R. L. Snyder, Wiley (1996).

課程教材 (教師個人網址請列在本校內之網址。)

(teaching aids & teacher's website)

Handouts and homework solutions will be available on the instructor's webpage in due dates.



與學系教育目標之關聯性(材料系)
(relation to educational objective of materials engineering department)

1. 提供材料性質、製程與應用及跨領域知識與訓練
To provide interdisciplinary know-how and training on materials properties, processing, and applications
2. 培育具獨立思考、創新與實作能力之材料科技人才
To train materials technology students for independent thinking, innovation, and practical skills
3. 培養團隊合作精神與溝通協調整合能力
To cultivate the spirit of teamwork and the capacity of integrated cooperation
4. 建立多元價值與國際觀
To inculcate multifarious values and cosmopolitan worldview
5. 強化綠色材料科技教育
To implement educational programs in eco-materials technology

與學系教育核心能力之關聯性(材料系)
(relation to educational core abilities for materials engineering department)

- (A) 運用數學、科學及材料工程知識能力
(ability to apply knowledge of mathematics, science, and materials engineering)
- (B) 設計與執行材料實驗及分析數據之能力
(ability to design and conduct experiments, as well as analyze data)
- (C) 執行材料工程實務所需之技術與能力
(ability to use techniques and skills for materials engineering practices)
- (D) 製程整合及元件實作之能力
(ability to integrate process and make devices)
- (E) 溝通協調之能力與團隊合作之精神
(ability to communicate effectively and cultivate the spirit of teamwork)
- (F) 獨立思考及解決問題之能力
(ability to think independently and solve problems)
- (G) 培養國際觀及認識綠色材料對全球環境的影響
(cultivation of cosmopolitan worldview and understanding effects of eco-materials on global environment)
- (H) 終身學習之習慣與能力
(ability to cultivate life-long learning habit)
- (I) 瞭解材料工程人員的社會責任與專業倫理
(understanding materials engineers' social responsibility and professional ethics)

課程內涵達成學系【教育目標】比對資料

授課進度與內容	核心能力				
	目標一	目標二	目標三	目標四	目標五
提供材料性質、製程與應用及跨領域知識與訓練	培育具獨立思考、創新與實作能力之材料科技人才	培養團隊合作精神與溝通協調整合能力	建立多元價值與國際觀	強調綠色材料科技教育	
請勾選關聯性 <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Introduction: History of X-Ray The continuous and characteristic spectrum	1	0	0	0	0
Filters Production of X-ray Detection of X-ray	1	0	0	0	0
Crystal lattices Miller Indices and Reciprocal Lattices	1	0	0	0	0
Crystal Systems Symmetry Operation and Point Groups	1	0	0	0	0
Bragg's Law Diffraction Methods	1	0	0	0	0
Scattering Theories Structural Factor Calculations (1)	1	1	0	0	0
Structural Factor Calculations (2)	1	1	0	0	0
Other Factors that may contribute to diffraction intensity	1	1	0	0	0
Diffraction from real samples: crystallite size, residual strains, amorphous samples	1	1	0	0	0
Diffractionmetry (1)	1	1	0	0	0
Diffractionmetry (2)	1	1	0	0	0
Phase identification: methods and practices	1	1	0	0	0
Phase identification: lab demonstration	1	1	0	0	0
Determination of crystal structure	1	0	0	0	0
Precise parameter measurements	1	0	0	0	0
Structure of polycrystalline aggregates	1	0	0	0	0
Stress measurement	1	0	0	0	0
Concluding remarks	1	0	0	0	0
總計(%)	100%	50%	0%	0%	0%

- 註：
1. 所有必修課均須填寫此表。
 2. 矩陣中請填入關聯性； 1 表示相關，0 表示無相關。
 3. 學系教育目標項次請依據表1填寫。



課程內涵達成學系【核心能力】比對資料(大學部)

授課進度與內容	核心能力								
	A	B	C	D	E	F	G	H	I
	運用數學、科學及材料工程知識能力	設計與執行材料實驗及分析數據之能力	執行材料工程實務所需之技術與能力	製程整合及元件製作之能力	溝通協調之能力與團隊合作之精神	獨立思考及解決問題之能力	培養國際觀及認識綠色材料對全球環境的影響	終身學習之習慣與能力	瞭解材料工程師的社會責任與專業倫理
請勾選關聯性 <input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Introduction: History of X-Ray The continuous and characteristic spectrum	1	1	1	0	0	0	0	0	0
Filters Production of X-ray Detection of X-ray	1	1	1	0	0	0	0	0	0
Crystal lattices Miller Indices and Reciprocal Lattices	1	1	1	0	0	0	0	0	0
Crystal Systems Symmetry Operation and Point Groups	1	1	1	0	0	0	0	0	0
Bragg's Law Diffraction Methods	1	1	1	0	0	0	0	0	0
Scattering Theories Structural Factor Calculations (1)	1	1	1	0	0	0	0	0	0
Structural Factor Calculations (2)	1	1	1	0	0	0	0	0	0
Other Factors that may contribute to diffraction intensity	1	1	1	0	0	0	0	0	0
Diffraction from real samples: crystallite size, residual strains, amorphous samples	1	1	1	0	0	0	0	0	0
Diffraction (1)	1	1	1	0	0	0	0	0	0
Diffraction (2)	1	1	1	0	0	0	0	0	0
Phase identification: methods and practices	1	1	1	0	0	0	0	0	0
Phase identification: lab demonstration	1	1	1	0	0	0	0	0	0
Determination of crystal structure	1	1	1	0	0	0	0	0	0
Precise parameter measurements	1	1	1	0	0	0	10	0	0
Structure of polycrystalline aggregates	1	1	1	0	0	0	0	0	0
Stress measurement	1	1	1	0	0	0	0	0	0
Concluding remarks	1	1	1	0	0	0	0	0	0
總計(%)	100%	100%	100%	0%	0%	0%	0%	0%	0%

- 註：
1. 所有必修課均須填寫此表。
 2. 矩陣中請填入關聯性；1表示相關，0表示無相關。
 3. 學系教育目標項次請依據表1填寫。