國立台灣科技大學 114學年 第2學期　課程大綱

Spring 2026 NTUST Course Outline

授課教師：黃彥瑞

Instructor:HUANG YEN-JUI

課程名稱：愛克斯光繞射及結晶學

Course Title：X-Ray Diffraction and Crystallography

2026/11/3

課程代號： ME6406701 Course Code 學分數： 3 Credits	必選修：選修/半學年 Required/Electve:Elective/Half Yr. 先修課程： Prerequisites
節次教室： T6(TR-213) T7(TR-213) T8(TR-213) Time/Location	
專業核心能力： Core Professional Competencies	
課程網址： Course Website	
課程宗旨： Course Objectives	This course introduces the principles of Crystallography and X-ray Diffraction. Lecture contents would cover crystalline structures, crystal defects, index, steregographic projection, symmetry and space groups and reciprocal lattice. Followed by the production and properties of X-ray, diffraction theories and diffraction methods. Then briefly introducing electron-material interactions, electron diffraction, kikuchi pattern, Transmission Electron Microscope (TEM) and Electron Backscattering Diffraction (EBSD). A three-hour lecture over Radiation Safety Training would be provided in mid semester. Course Objective: 1. Be able to describe and classify crystalline structures, crystal defects and symmetry. 2. Obtain essential knowledge in X-ray diffraction and electron diffraction. 3. Familiar with X-ray diffractometer, electron microscopes and data analysis tools. 4. Using crystallographic principles to explain material properties. 5. Apply diffraction techniques to analyze crystal structures of materials. 本課程介紹晶體學和X射線繞射原理。課程內容包括晶體結構、晶體缺陷、指標、立體投影、對稱性、空間群、倒晶格、布拉格定律。隨後講解X射線的產生和性質、繞射理論和繞射方法。之後簡單介紹電子與材料的相互作用、電子繞射、菊池線、電子背散射繞射(EBSD)及穿透式電子顯微鏡(TEM)。學期中另安排三小時進行輻射安全訓練講習。預期學生可獲得下述能力：(1) 能夠描述晶體結構、晶體缺陷和對稱性並予以分類、(3)掌握X射線繞射和電子繞射的基本知識、(3)熟悉X射線繞射儀和電子顯微鏡、(4)應用繞射技術分析材料晶體結構、(5)利用晶體學原理解釋材料特性。
課程大綱： Outline of Lectures	

	- Week 1~3: Crystalline structures, Crystal defects, Miller indices, Stereographic projections - Week 4~6: Symmetry, Point and space groups, Reciprocal lattice, Bragg's law, Ewald sphere, Laue equation - Week 7: Electron-material interaction, Characterisitic X-ray, Production and properties of X-ray - Week 8: Midterm - Week 9~10: X-ray diffraction, Debye-Scherrer method, Diffractometers, Measurements and data analysis - Week 11: Radiation Safety Training - Week 12~15: Elastic vs. inelastic scattering, Electron microscope (TEM/SEM), Electron diffraction (Selected Area Electron Diffraction), Kikuchi lines in TEM, Electron Backscatter Diffraction - Week 16: Final exam 晶體結構、晶體缺陷、指標、立體投影 (3週)；對稱性、空間群、倒晶格、布拉格定律(3週)；電子材料交互作用、特徵X射線、X射線產生和性質(1週)；繞射理論、繞射方法、X射線繞射儀(2週)；輻射安全訓練課程(1週)；彈性非彈性散射、電子顯微鏡、電子繞射、菊池線、電子背向散射繞射(EBSD)(4週)。
授課方式： Method of Instruction	講授 Lecture：100% 分組討論 Group discussion：0% 案例研討 Case study：0% 操做練習 Practical exercises：0% 講授 Lecture：%
教科書： Textbooks	1. Christopher Hammond, “The Basics of Crystallography and Diffraction”, 2nd Edition, Oxford University Press, 2001 2. B. D. Cullity, Elements of X-Ray Diffraction, 3rd ed., Prentice Hall, 2001
參考書目： References	
修課須知： Notice	
評量方式： Grading	出席20%、期中40%、期末40%
備註說明： Notes	-先修課程：材料科學與工程導論 -出席：學生進入教室時須在簽到表上簽名，不得代他人簽到。上課期間，請將手機及其他電子設備調至靜音模式，以免干擾其他同學 -誠信政策：考試中請勿作弊。學生有義務在所有學術作業和軟體/應用程式使用中保持誠實。期中和期末考為手寫閉卷考試，請攜帶工程計算器或已安裝在任何電子設備中的相關應用程式，考試時間預計為100分鐘，具體時長視學生程度而定。除疾病、受傷或家庭緊急狀況等特殊情況外，不安排補考。