

教學大綱(Syllabus)

Updated: 2011/08/26

課程編碼 (course no.)	D007			學分 (credits)	3	
課程名稱 (course name)	(中) 高等固態擴散					
課程名稱 (course name)	(Eng.) Advanced Diffusion in Solids					
開課系所班級 (dept. & year)	材料科學與工程學系博士班一年級 (Dept. of Materials Science and Engineering, Ph.D.)			授課教師 (teacher)	薛顯宗 教授 (Prof. Sham-Tsong Shiue)	
課程類別 (course type)	選 修 (Elective)	授課語言 (language)	中文 (Chinese)	開課學期 (semester)	上學期 (Fall)	
課程簡述 (course description)	<p>(中) 課程的目的是為了讓學生充分了解高等固態擴散的基本理論以及在材料科學與工程中擴散的應用。並以微觀之原子理論與巨觀之現象理論，二方面之觀點加以探討。</p> <p>(Eng.) The purpose of this course is to teach the student to understand the basic theory of advanced diffusion in solids and the application of diffusion in materials science and engineering. Besides, the atomic theory in microscopic dimension and the phenomenology of diffusion in macroscopic dimension are studied in this semester.</p>					
課程目標 (course objectives)	<p>(中)</p> <ol style="list-style-type: none"> 1. 了解高等固態擴散的基本理論以及在材料中擴散的應用。就微觀的原子理論與巨觀的現象理論等二方面觀點加以探討。 2. 了解固體中在不同溫度下擴散行為及發生的相改變。學習原子在固體中如何移動並清楚了解擴散在所有結晶固體中的物理意義。 3. 了解固體擴散在材料科學與工程的重要性及影響。應用高等固態擴散的原理，評估一材料系統並提出正確的擴散模式。 4. 讓同學熟悉擴散之數學模式與工程應用。就原子理論與非可逆熱力學，探討擴散之機構，反應速率，驅動力與相關之效應，並就二元、多元、多相系統進行分析。 5. 知道如何收集高等固態擴散的相關資訊、研究結果，並可評估所獲資訊的適用性。能針對一特定有關高等固態擴散的議題，適切歸納出結論。再以書面方式將所獲結果與同儕、助教及教師溝通討論。 					

(Eng.)

1. To understand the basic theory of advanced diffusion in solids and the diffusion behavior in materials in real case. In this course, it will discuss from the two concepts of the atomic theory in microscopic dimension and the phenomenology of diffusion in macroscopic dimension.
2. To understand the diffusion behavior and phase transformation in solids at different temperature. To learn how to move for the atoms in solids and understand the physical meanings of diffusion behavior in crystalline solids.
3. To understand the effect of diffusion in solids on the materials science and engineering. Using the theory of advanced diffusion in solids, the learners must study to estimate a material system and determine the correct diffusion model on this system.
4. To know the mathematical diffusion model and how to apply to the engineering field. From the viewpoint of the atom theory and the irreversible thermodynamics, it is discussed and analyzed the diffusion mechanism, reaction rate, driving force and relative reactions at the binary elements, multi-element multi-phase system.
5. To know how to collect the information and research results of advanced diffusion in solids, and study a method to determine available information that you get. For the specific issue of advanced diffusion in solids, the learners must try to summary the data and make a conclusion. Though the homework paper on this course, it will help learners, teaching assistants and teacher to discuss with each other.

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)			
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.)	2.5	0.5			3
	授課時數分配 (hour distrib.)	2.5	0.5			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)	
01-03	Diffusion equations					
04-05	Atomic theory of diffusion					
06-07	Diffusion in dilute alloys					
08	Midterm exam.		Midterm exam.			
09-10	Diffusion in concentration gradient					
11-12	Diffusion in non-metals					
13-14	High diffusivity paths					
15	Thermo-and electro-transport					
16	Final report					
17	Final exam.		Final exam.			



**學習評量方式
(evaluation)**

1. 學期成績計算項目及權重標準如下：

A. Midterm exam	30%
B. Final exam	30%
C. Homework assignment	10%
D. Final report	30%
2. 考試 (Midterm exam、Final exam)：
期中、期末考均配合學校考試時程。內容包含所有講授內容與參考書中部分教材。
3. 作業 (Homework assignment)：
讓同學熟悉擴散之數學模式與工程應用，就原子理論與非可逆熱力學、探討擴散之機構，反應速率，驅動力與相關之效應，並就二元多元、多相、系統作系統分析之敘述。使同學對每一周的講授內容能夠更加了解。
4. 期末報告：(Final report)：
此為本課程最重要的學習活動之一，報告評估重點在於透過文獻搜集與報告撰寫，使學生對固態擴散有較深入之瞭解。亦即從題目定義、理論基礎、解決方法步驟、以及分析討論等均需具正確性。

**教科書 (書名、作者、書局、代理商、說明)
(textbook)**

1. Diffusion in solids, Second edition, Paul Shewmon

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

1. Journal paper

**課程教材 (教師個人網址請列在本校內之網址。)
(teaching aids & teacher's website)**

1. <http://web.nchu.edu.tw/~stshiue/>

與學系教育目標之關聯性(材料系) (相關請勾選)
(relation to educational mission 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) (相關請勾選)
(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)