

## 教學大綱(Syllabus)-大學部

系務會議通過日期:2007/9/12

updated: 2010//08/26

|                                      |  |                            |                           |                                 |               |
|--------------------------------------|--|----------------------------|---------------------------|---------------------------------|---------------|
| <b>課程編碼<br/>(course no.)</b>         | U004   |                            |                           | <b>學分<br/>(credits)</b>         | 3             |
| <b>課程名稱<br/>(course name)</b>        | (中) 物理冶金 (上)   |                            |                           |                                 |               |
|                                      | (Eng.) Physical Metallurgy (I)   |                            |                           |                                 |               |
| <b>開課系所班級<br/>(dept. &amp; year)</b> | 材料科學與工程學系大學部二年級<br>(Dept. of Mat. Sci. & Engr., Sophomore)   |                            | <b>授課教師<br/>(teacher)</b> | 張守一 教授<br>(Prof. Shou-Yi Chang) |               |
| <b>課程類別<br/>(course type)</b>        | 必修<br>(Mandatory)  | <b>授課語言<br/>(language)</b> | 中文<br>(Chinese)           | <b>開課學期<br/>(semester)</b>      | 上學期<br>(Fall) |
| <b>課程簡述<br/>(course description)</b> | <p>(中) 本課程講述物理冶金重要知識，針對材料結構、分析方法、晶體鍵結、差排、塑性變形、晶界、空孔、退火、固溶體及相等內容，做一詳細介紹，使學生能建立材料科學之基礎知識，並進一步將所學與未來相關研究結合。此課程為以課堂授課為主，並將另外安排教學助理時間，針對作業進行討論。</p> <p>(Eng.) This course introduces the important knowledge of physical metallurgy. The structure of materials, analytical methods, crystal binding, dislocations, plastic deformation, grain boundaries, vacancies, annealing, solid solutions and phases are stated in detail. The objective of this course is to establish the basic knowledge of materials science for the students and to further connect the knowledge to related future researches. This course is a lecture-oriented course. Teaching assistant's time will be arranged for the discussion of homework.</p>  |                            |                           |                                 |               |
| <b>課程目標<br/>(course objectives)</b>  | <p>(中)</p> <ol style="list-style-type: none"> <li>1. 瞭解材料之結構與分析方法</li> <li>2. 瞭解材料內部之晶體鍵結</li> <li>3. 瞭解材料內部之差排結構與機制</li> <li>4. 瞭解材料之塑性變形行為與機制</li> <li>5. 瞭解材料內部之晶界與空孔結構</li> <li>6. 瞭解退火處理與其相關影響</li> <li>7. 瞭解固溶體之結構及相之觀念</li> <li>8. 培養學生解決問題的能力</li> <li>9. 培養學生收集資料的能力</li> <li>10. 培養同學書面報告的能力</li> <li>11. 培養同學團隊合作精神</li> </ol> <p>(Eng.)</p> <ol style="list-style-type: none"> <li>1. To understand the structure of materials and analytical methods</li> <li>2. To understand the crystal binding of materials</li> <li>3. To understand dislocations and their mechanism in materials</li> <li>4. To understand the plastic deformation of materials</li> <li>5. To understand grain boundaries and vacancies in materials</li> <li>6. To understand annealing treatment and its effects</li> <li>7. To understand solid solution structures and phases</li> <li>8. To cultivate the capability of problem solving</li> <li>9. To cultivate the capability of information collection</li> <li>10. To cultivate the capability of presentation</li> <li>11. To cultivate the spirit of teamwork</li> </ol> |                            |                           |                                 |               |



| 先修課程(prerequisites)   |  |                  |  |                           |                                  |             |
|---|--|------------------|--|---------------------------|----------------------------------|-------------|
| 課程編碼<br>(course no.)  | 課程名稱<br>(course name)  |                  | 與課程銜接的重要概念、原理與技能<br>(relation to the current course) |                           |                                  |             |
|   |  |                  |  |                           |                                  |             |
|   |  |                  |  |                           |                                  |             |
| 教學模式<br>(teaching methodology)  | 模式<br>(methodology)  | 講授<br>(teaching) | 討論/報告<br>(discussion & report)                       | 實驗/參訪<br>(exp./fab visit) | 遠距/網路教學<br>(remote/web teaching) | 合計<br>(sum) |
|   | 學分分配<br>(credit distrib.)                                    | 3.0              |  |                           |                                  | 3.0         |
|   | 授課時數分配<br>(hour distrib.)                                    | 3.0              |  |                           |                                  | 3.0         |
| 授課進度與內容 (週次、單元名稱與內容、習作/考試進度、備註)<br>(course content and homework/tests schedule) |  |                  |  |                           |                                  |             |
| 週次<br>(week)  | 單元名稱與內容<br>(subject and content)                             |                  | 習作/考試進度<br>(homework and tests)                      |                           | 備註<br>(remark)                   |             |
| 01  | The Structure of Metals – Crystal Structure                  |                  |  |                           |                                  |             |
| 02  | The Structure of Metals – Standard Projections               |                  | Homework   |                           |                                  |             |
| 03  | Analytical Methods – X-Ray Diffraction                       |                  |  |                           |                                  |             |
| 04  | Analytical Methods – Microscopy                              |                  | Homework   |                           |                                  |             |
| 05  | Crystal Binding  |                  | Homework   |                           |                                  |             |
| 06  | Introduction to Dislocations – Dislocation Structures        |                  |  |                           |                                  |             |
| 07  | Introduction to Dislocations– Stress Field and Strain Energy |                  | Homework   |                           |                                  |             |
| 08  | Dislocations and Plastic Deformation – Slip                  |                  |  |                           |                                  |             |
| 09  | Midterm Examination  |                  | Midterm Examination                                  |                           |                                  |             |
| 10  | Dislocations and Plastic Deformation – Plastic Deformation   |                  | Homework   |                           |                                  |             |
| 11  | Grain Boundaries – Stress Field and Energy                   |                  |  |                           |                                  |             |
| 12  | Grain Boundaries – Twist and Tilt Boundaries                 |                  | Homework   |                           |                                  |             |
| 13  | Vacancies  |                  | Homework   |                           |                                  |             |
| 14  | Annealing – Recovery and Recrystallization                   |                  |  |                           |                                  |             |
| 15  | Annealing – Grain Growth                                     |                  | Homework   |                           |                                  |             |
| 16  | Solid Solutions  |                  | Homework   |                           |                                  |             |
| 17  | Phases   |                  | Homework   |                           |                                  |             |
| 18  | Final Examination  |                  | Final Examination                                    |                           |                                  |             |



**學習評量方式**

**(evaluation)**

- (1) Midterm Examination: 40%
- (2) Final Examination: 50%
- (3) Homework: 10%

**期中考試 (Midterm Examination) :**

期中考試之目的主要在於評量學生對課堂講授資料的了解程度，培養同學課後複習的習慣以及思考問題的能力，並且作為課程內容調整之依據。

**期末考試 (Final Examination) :**

期末考試之目的主要在於評量學生對課堂講授資料的了解程度，培養同學課後複習的習慣以及思考問題的能力，並且作為課程內容調整之依據。

**作業 (Homework) :**

針對課程章節安排作業，其主要目的在於提供學生自我學習的機會，可讓學生更加熟悉課程內容，並培養學生蒐集整理資料以及分析解決問題的能力，同時可培養學生撰寫報告的能力。

**教科書 (書名、作者、書局、代理商、說明)**

**(textbook)**

“Physical Metallurgy Principles”, R.E. Reed-Hill and R. Abbaschian, 3rd edition, PWS Publishing Co., 1994.

**參考書目 (書名、作者、書局、代理商、說明)**

**(other references)**

**課程教材 (教師個人網址請列在本校內之網址。)**

**(teaching aids & teacher's website)**

Power Point Files

<http://www.mse.nchu.edu.tw/>



**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【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                    | 製程整合及元件實作之能力             | 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                          | 瞭解材料工程師人員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 checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> | <input checked="" type="checkbox"/> |
| The Structure of Metals – Crystal Structure                   | 1                                   | 1                                   | 0                                   | 0                        | 0                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| The Structure of Metals – Standard Projections                | 1                                   | 1                                   | 0                                   | 0                        | 1                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Analytical Methods – X-Ray Diffraction                        | 1                                   | 1                                   | 1                                   | 0                        | 0                                   | 1                                   | 0                                   | 1                                   | 1                                   |
| Analytical Methods – Microscopy                               | 1                                   | 1                                   | 1                                   | 0                        | 1                                   | 1                                   | 0                                   | 1                                   | 1                                   |
| Crystal Binding   | 1                                   | 1                                   | 0                                   | 0                        | 1                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Introduction to Dislocations – Dislocation Structures         | 1                                   | 1                                   | 0                                   | 0                        | 0                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Introduction to Dislocations – Stress Field and Strain Energy | 1                                   | 1                                   | 0                                   | 0                        | 1                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Dislocations and Plastic Deformation – Slip                   | 1                                   | 1                                   | 0                                   | 0                        | 0                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Midterm Examination   | 1                                   | 1                                   | 0                                   | 0                        | 0                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Dislocations and Plastic Deformation – Plastic Deformation    | 1                                   | 1                                   | 0                                   | 0                        | 1                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Grain Boundaries – Stress Field and Energy                    | 1                                   | 1                                   | 0                                   | 0                        | 0                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Grain Boundaries – Twist and Tilt Boundaries                  | 1                                   | 1                                   | 0                                   | 0                        | 1                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Vacancies   | 1                                   | 1                                   | 0                                   | 0                        | 1                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| Annealing – Recovery and Recrystallization                    | 1                                   | 1                                   | 1                                   | 0                        | 0                                   | 1                                   | 1                                   | 1                                   | 0                                   |
| Annealing – Grain Growth                                      | 1                                   | 1                                   | 1                                   | 0                        | 1                                   | 1                                   | 1                                   | 1                                   | 0                                   |
| Solid Solutions   | 1                                   | 1                                   | 1                                   | 0                        | 1                                   | 1                                   | 1                                   | 1                                   | 0                                   |
| Phases  | 1                                   | 1                                   | 1                                   | 0                        | 1                                   | 1                                   | 1                                   | 1                                   | 0                                   |
| Final Examination   | 1                                   | 1                                   | 0                                   | 0                        | 0                                   | 1                                   | 0                                   | 1                                   | 0                                   |
| 總計(%)   | 100%                                | 100%                                | 33%                                 | 0%                       | 56%                                 | 100%                                | 22%                                 | 100%                                | 11%                                 |

- 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。