教學大綱(Syllabus)-研究所

系務會議通過修訂日期：2007/9/12

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| 課程編碼  **(course no.)** | G20 | | | 學分  **(credits)** | ３ |
| 課程名稱  **(course name)** | (中) 凝固與鑄造 | | | | |
| (Eng.) Solidification and Casting | | | | |
| 開課系所班級  **(dept. & year)** | 材料科學與工程學系碩士班一年級  (Dept. of Mat. Sci. & Engr.,Master) | | | 授課教師  **(teacher)** | 施漢章 教授  (Prof. Han Chang Shih) |
| 課程類別  **(course type)** | 選修  (Elective) | 授課語言  **(language)** | 中文  (Chinese) | 開課學期  **(semester)** | 下學期  (Spring) |
| 課程簡述 **(course description)** | (中) 使學生了解金屬及合金材料之熔鑄過程及其相關之理論，也使學生熟習模具之設計與選用，培養學生有能力分析鑑定鑄件之各類缺陷以及鑄件在工業上的應用． | | | | |
| (Eng.) To enable students to understand the melting and casting process of metal and alloy materials and related theories, also to familiarize students with the design and selection of molds, to cultivate students' ability to analyze and identify various defects of castings and the application of castings in industry | | | | |
| 課程目標 **(course objectives)** | (中)  均質成核與非均質成核  液體與固體之相變，快速凝固，單晶成長  共晶與多晶之方向控制成長及其應用  平衡相圖及成份過冷，平面界面之不穩定現象  胞狀及樹枝狀之組成及形態，微偏析及微收縮孔  對流與宏觀缺陷組織  砂模,鋼模及其它模澆口,冒口,流道之設計  殼模鑄造及精密鑄造  鑄件之微觀成份與結構分析、機械強度及熱處理 | | | | |
| (Eng.)  Homogeneous and heterogeneous nucleation  Phase transition between liquid and solid, rapid solidification, single crystal growth  Direction-controlled growth of eutectic and polycrystalline and its application  Equilibrium phase diagram and composition supercooling, unstable phenomenon of plane interface  Cellular and dendritic composition and morphology, micro-segregation and micro-shrinkage pores  Convective and macroscopic defect organization  Design of gates, risers and runners for sand molds, steel molds and other molds  Shell mold casting and precision casting  Microscopic composition and structure analysis, mechanical strength and heat treatment of castings | | | | |

updated: 2007/10/04

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| 先修課程**(prerequisites)** | | | | | | | | | | | |
| 課程編碼  (course no.) (course name) (relation to the current course) | | | 課程名稱 | | | 與課程銜接的重要概念、原理與技能 | | | | | |
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| 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 | 均質成核與非均質成核 | | | | | |  | | |  | |
| 02 | 液體與固體之相變 | | | | | |  | | |  | |
| 03 | 相關之熱力學與動力學--總複習 | | | | | |  | | |  | |
| 04 | 快速凝固 | | | | | | Homework #1 | | |  | |
| 05 | 單晶成長 | | | | | |  | | |  | |
| 06 | 共晶與多晶之方向控制成長及其應用 | | | | | |  | | |  | |
| 07 | 平衡相圖及成份過冷 | | | | | | Homework #2 | | |  | |
| 08 | 平面界面之不穩定現象 | | | | | |  | | |  | |
| 09 | midterm exam | | | | | |  | | |  | |
| 10 | 胞狀及樹枝狀之組成及形態 | | | | | |  | | |  | |
| 11 | 微偏析及微收縮孔 | | | | | |  | | |  | |
| 12 | 對流與宏觀缺陷組織 | | | | | |  | | |  | |
| 13 | 砂模,鋼模及其它模 | | | | | | Homework #3 | | |  | |
| 14 | 澆口,冒口,流道之設計 | | | | | |  | | |  | |
| 15 | 殼模鑄造及精密鑄造 | | | | | |  | | |  | |
| 16 | 鑄件之微觀成份與結構分析 | | | | | | Homework #4 | | |  | |
| 17 | 鑄件之機械強度及熱處理 | | | | | |  | | |  | |
| 18 | final exam | | | | | |  | | |  | |
| 學習評量方式 | | | | | | | | | | | |
| **(evaluation)** | | | | | | | | | | | |
| 1. Homework assignment: 20% 2. Midterm Examination 40% 3. Final Examination 40%   期中考（Midterm）：  目的在評估學生對課堂講授資料的了解程度。  作業（Homework）：  作業共 4 次，目的在評估學生對課堂講授資料以及同分組報告資料的了解程度，並且培養同學平日課後複習的習慣以及思考問題的能力。  期中與期末考試（Midterm and Final Examination）：  期中與期末考試測驗各一次，目的在於評估學生對於電漿製程授課的了解度。 | | | | | | | | | | | |
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| 教科書（書名、作者、書局、代理商、說明）  **(textbook)** | | | | | | | | | | | |
|  | | | | | | | | | | | |
| 參考書目（書名、作者、書局、代理商、說明  **(other references)** | | | | | | | | | | | |
| 1.“Science and Engineering of Casting Solidification( 2nd ed.)”, D.M. Stefanescu , Springer, 2008.  2.“Metal Casting: A Sand Casting Manual for Small Foundry, vol II”, Stephen Chastain, 2004, ISBN: 978-0-9702203-3-2.  3.“Casting ( 2nd ed.)”, John Campbell , Butterworth-Heinemann, 2003.  4.“Fundamentals of Metal Casting”, R.A. Flinn, University of Michigan,1978.  5.“Solidification Processing”, Flemings, McGraw-Hill, Inc.1974.  6.“Casting and Solidification ”, G.J. Davies, Applied Science Publishers LTD, 1973.  7.“Transformation in Metals”, P.G.Shewmon, McGraw-Hill, Inc.1969.  8.“Casting Processes”, Lectures by Zulkepli Muhamad, Faculty of Mechanical Engineering, UTM, Malaysia.  9.“鑄造學”張晉昌,全華圖書,2010。  10.“鑄造學”林文和,邱傳聖,高立出版集團,2008。  11.“製模與鑄造”程嘉垕,中國工程師學會, 1967 | | | | | | | | | | | |
| 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. | | | | | | | | | | | |

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| 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) 特定材料之專業知識  Specialized knowledge in Materials science and Engineering  (B) 策劃及執行專題研究之能力  Ability to plan and execute a research project  (C) 撰寫專業論文之能力  Ability to write journal articles  (D) 創新思考及獨立解決問題之能力  Ability to do innovative thinking and independent problem solving  (E) 跨領域協調整合之能力  Ability to work in an interdisciplinary setting  (F) 國際觀及綠色材料意識  A fine international scope and general concept of eco-material  (G) 領導、管理及規劃之能力  Ability in leadership, management, and organization  (H) 終身自我學習成長之能力  Ability for life-long learning  ( I ) 學術專業倫理  Professional ethics in Science and Engineering |

# 課程內涵達成學系【教育目標】比對資料

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| --- | --- | --- | --- | --- | --- |
| 授課進度與內容 | 教育目標 | | | | |
| 目標一 | 目標二 | 目標三 | 目標四 | 目標五 |
| 提供材料 | 培育具獨 | 培養團 隊 | 建立多 元 | 強化綠色 |
| 性質、製程 與應用及 | 立思考、創 新與實作 | 合作精 神 與溝通 協 | 價值與 國  際觀 | 材料科技 教育 |
| 跨領域知 | 能力之材 | 調整合 能 |
| 識與訓練 | 料科技人 | 力 |
| 才 |
| 請勾選關聯性🗹 | 🗹 | 🗹 | 🗹 | □ | 🗹 |
| Overall Introduction | 1 | 1 | 0 | 0 | 1 |
| Special example: Cu metallization | 1 | 1 | 0 | 0 | 0 |
| Review of materials science | 1 | 1 | 0 | 0 | 0 |
| Vacuum science & technology: kinetic theory of gases, gas  transport & pumping | 1 | 1 | 0 | 0 | 0 |
| Vacuum science & technology: vacuum pumps & vacuum  systems | 1 | 1 | 0 | 0 | 0 |
| practice | 1 | 1 | 0 | 0 | 0 |
| Physical Vapor Deposition: physics & chemistry of  evaporation; uniformity & purity | 1 | 1 | 0 | 0 | 0 |
| Physical Vapor Deposition: evaporation hardware &  techniques; glow discharge & plasmas | 1 | 1 | 0 | 0 | 0 |
| Physical Vapor Deposition: sputtering & sputtering process | 1 | 1 | 0 | 0 | 0 |
| Chemical Vapor Deposition: Introduction; reaction types | 1 | 1 | 0 | 0 | 0 |
| Chemical Vapor Deposition: Thermodynamics; transport;  kinetics | 1 | 1 | 0 | 0 | 0 |
| Computer simulation | 1 | 1 | 0 | 0 | 0 |
| Film formation & structure: introduction; capillarity theory | 1 | 1 | 0 | 0 | 0 |
| Film formation & structure: capillarity theory | 1 | 1 | 0 | 0 | 0 |
| Film formation & structure: atomistic nucleation process | 1 | 1 | 0 | 0 | 0 |
| Film formation & structure: cluster coalescence & depletion;  grain structure | 1 | 1 | 0 | 0 | 0 |
| Final presentation | 1 | 1 | 1 | 0 | 0 |
| Final presentation | 1 | 1 | 1 | 0 | 0 |
| 總計(%) | 100% | 100% | 11% | 0% | 5% |

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(研究所)

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| 授課進度與內容 | 核心能力 | | | | | | | | |
| A | B | C | D | E | F | G | H | I |
| 運用數學 | 設計與執 | 執行材料 | 製程整 | 溝通協 | 獨立思 | 培養國 | 終身學 | 瞭解材 |
| 、科學及 | 行材料實 | 工程實務 | 合及及 | 調之能 | 考及解 | 際觀及 | 習之習 | 料工程 |
| 材料工程 | 驗及分析 | 所需之技 | 元件實 | 力與團 | 決問題 | 認識綠 | 慣與能 | 人員的 |
| 知識能力 | 數據之能 | 術與能力 | 作之能 | 隊合作 | 之能力 | 色材料 | 力 | 社會責 |
| 力 | 力 | 之精神 | 對全球 | 任與專 |
| 環境的 | 業倫理 |
| 影響 |
| 請勾選關聯性🗹 | 🗹 | 🗹 | 🗹 | □ | □ | 🗹 | □ | □ | □ |
| Overall Introduction | 1 | 1 | 1 | 0 | 0 | 1 | 0 | 0 | 0 |
| Special example: Cu metallization | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Review of materials science | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vacuum science & technology: kinetic theory of gases, gas  transport & pumping | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Vacuum science & technology: vacuum pumps & vacuum  systems | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| practice | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Physical Vapor Deposition: physics & chemistry of  evaporation; uniformity & purity | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Physical Vapor Deposition: evaporation hardware &  techniques; glow discharge & plasmas | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Physical Vapor Deposition: sputtering & sputtering process | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chemical Vapor Deposition: Introduction; reaction types | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Chemical Vapor Deposition: Thermodynamics; transport;  kinetics | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Computer simulation | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Film formation & structure: introduction; capillarity theory | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Film formation & structure: capillarity theory | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Film formation & structure: atomistic nucleation process | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Film formation & structure: cluster coalescence &  depletion; grain structure | 1 | 1 | 1 | 0 | 0 | 0 | 0 | 0 | 0 |
| Final presentation |  |  |  |  |  |  |  |  |  |
| 總計(%) | 100% | 100% | 100% | 0% | 0% | 5% | 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。