



教學大綱(Syllabus)-研究所

系務會議通過修訂日期：2008/01/03

updated: 2008/01/

課程編碼 (course no.)	M021		學分 (credits)	3
課程名稱 (course name)	(中) 陶瓷製程			
	(Eng.) Ceramics Processing			
開課系所班級 (dept. & year)	材料工程學系碩士班一年級 (Dept. of Mat. Sci. & Engr., Master)		授課教師 (teacher)	曾文甲 教授 (Prof. Wenjea J. Tseng)
課程類別 (course type)	選修 (optional)	授課語言 (language)	中文 (Chinese)	開課學期 (semester)
				下學期(Spring)
課程簡述 (course description)	<p>(中) 陶瓷材料早已跳脫傳統的碗盤、衛浴器材等之應用，進入高科技領域例如：電腦、TFT-LCD、手機、汽車、人工關節、甚至太空梭之隔熱片等尖端科技元件之應用。本課程的教授內容將針對陶瓷材料與元件的製程，及在製作參數的選擇與隱身其後之理論基礎作選擇性的介紹。課程進度將針對先進陶瓷材料與元件，在以粉體為出發材料時的乾式與溼式製程開始，配合製作過程中有關界面化學與有機添加助劑的基礎介紹，發展至製程參數對成形體的微觀缺陷以及燒結微觀結構對陶瓷材料的物理性質之影響；此外，先進陶瓷材料與元件的製作不藉由固態粉體出發，而直接由液態與氣態方式獲得緻密化陶瓷結構亦在近期獲得愈來愈多的注目，本課程亦將涵括此相關內容。期間有關陶瓷製程的最新發展將搭配講義與論文閱讀的方式作介紹。</p> <p>(Eng.) A marked departure from traditional ceramics in applications such as dishes and bathroom wares, modern ceramics finds niche applications in hi-tech sectors such as in emerging technologies of computer, TFT-LCD, mobile phone, automobile, artificial biomedical device, and even in space shuttle. This course is then intended to give students an introductory overview of how the modern ceramics are being fabricated and the underlying fundamentals behind the processes. The course is designed to start from the powder routes (including both the dry and wet processes) for ceramics fabrication, followed then by the inter-relationship between the processes and microstructures attained. Ceramics not from powders as a starting material, but from liquid and vapor states will also be introduced. Extensive examples addressing the recent development will be included in class via class handouts and paper readings.</p>			
課程目標 (course objectives)	(中) 使修課同學具備基礎陶瓷製程之專業知識與實作能力			
	(Eng.) To understand fundamental ceramics processing knowledge and practices			

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)				
	陶瓷材料 (Ceramics materials)	陶瓷晶體結構、燒結理論、陶瓷微結構 (Ceramic crystal structure, sintering theory, ceramic microstructure)				
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	0.4	0.1		
	授課時數分配 (hour distrib.)	2.5	0.4	0.1		



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		
02	Ceramics processing and ceramic products	Homework/reading assignment 1	
03	Ceramic raw materials and characterizations		
04	Powder route – pre-forming processes (1)	Homework/reading assignment 2	
05	Powder route – pre-forming processes (2)		
06	Powder route – pre-forming processes (3)		
07	Powder route – dry and wet forming process (slip casting and rheology)		
08	Powder route – wet forming process: fundamentals in surface chemistry	Homework/reading assignment 3	
09	Powder route – wet forming process: fundamentals of interparticle forces in liquid		Laboratory tour and practice
10	Exam week	Midterm written exam	
11	Powder route – wet forming process: tape casting and other novel colloidal processes	Homework/reading assignment 4	Laboratory tour and practice
12	Powder route – wet forming process: injection molding and extrusion		
13	Powder route – post-forming processes		
14	Liquid route – sol gel, gel casting, etc.	Homework/reading assignment 5	
15	Vapor route – deposition methods		
16	Sintering		
17	Term paper oral presentation (1)		
18	Term paper oral presentation (2)	Written term paper due	
學習評量方式 (evaluation)			

Midterm exam (written) 35%

Homework, reading assignments and class attendance 15%

Term paper (oral and written report) 50%

教科書 (書名、作者、書局、代理商、說明)

(textbook)

Ceramic Processing, M. N. Rahaman, CRC, 2007.

Principles of Ceramics Processing, James S. Reed, Wiley, 1995. (國內代理：民全書局)

參考書目 (書名、作者、書局、代理商、說明)

(other references)

Physical Ceramics: Principles for Ceramic Science and Engineering, Y.-M. Chiang et al., Wiley, 1997.

課程教材 (教師個人網址請列在本校內之網址。)

(teaching aids & teacher's website)

Class handouts will be delivered to students by email at least one week prior the class.



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

授課進度與內容	教育目標				
	目標一 提供材料性質、製程與應用及跨領域知識與訓練	目標二 培育具獨立思考、創新與實作能力之材料科技人才	目標三 培養團隊合作精神與溝通協調整合能力	目標四 建立多元價值與國際觀	目標五 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 checked="" type="checkbox"/>		
Introduction	1				
Ceramics processing and ceramic products	1				
Ceramic raw materials and characterizations	1				
Powder route – pre-forming processes (1)	1				
Powder route – pre-forming processes (2)	1				
Powder route – pre-forming processes (3)	1				
Powder route – dry and wet forming process (slip casting and rheology)	1				
Powder route – wet forming process: fundamentals in surface chemistry	1				
Powder route – wet forming process: fundamentals of interparticle forces in liquid	1				
Powder route – wet forming process: tape casting and other novel colloidal processes	1				
Powder route – wet forming process: injection molding and extrusion	1				
Powder route – post-forming processes	1				
Liquid route – sol gel, gel casting, etc.	1				
Vapor route – deposition methods	1				
Term paper oral presentation (1)		1	1		
Term paper oral presentation (2)		1	1		
Lab tour and practice		1	1		
總計(%)	85%	15%	15%		

- 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)

授課進度與內容	核心能力								
	A	B	C	D	E	F	G	H	I
	特定材料之專業知識	策劃及執行專題研究之能力	撰寫專業論文之能力	創新思考及獨立解決問題之能力	跨領域調整之能力	國際觀及綠色材料意識	領導及管理之能力	終身自我學習成長之能力	學術專業倫理
請勾選關聯性☑	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>	<input checked="" type="checkbox"/>					
Introduction	1								
Ceramics processing and ceramic products	1								
Ceramic raw materials and characterizations	1								
Powder route – pre-forming processes (1)	1								
Powder route – pre-forming processes (2)	1								
Powder route – pre-forming processes (3)	1								
Powder route – dry and wet forming process (slip casting and rheology)	1								
Powder route – wet forming process: fundamentals in surface chemistry	1								
Powder route – wet forming process: fundamentals of interparticle forces in liquid	1								
Powder route – wet forming process: tape casting and other novel colloidal processes	1								
Powder route – wet forming process: injection molding and extrusion	1								
Powder route – post-forming processes	1								
Liquid route – sol gel, gel casting, etc.	1								
Vapor route – deposition methods	1								
Term paper oral presentation (1)	1	1	1						
Term paper oral presentation (2)	1	1	1						
Lab tour and practice	1	1		1					
總計(%)	100	10	10	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。