



教學大綱(Syllabus)-大學部

系務會議通過修訂日期：

updated: 2010/8/29

課程編碼 (course no.)				學分 (credits)	3
課程名稱 (course name)	(中) 陶瓷材料與製程				
	(Eng.) Ceramic Materials and Processes				
開課系所班級 (dept. & year)	材料科學與工程學系碩專班 (Dept. of Mat. Sci. & Engr., Junior)			授課教師 (teacher)	曾文甲教授 (Prof. Wenjea J. Tseng)
課程類別 (course type)	選修 (Elective Course)	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) 陶瓷材料早已擺脫傳統的碗盤、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。本課程會針對陶瓷材料的結構(Structure)、性質(Property)與應用(Application)做一深入淺出的介紹，期使同學對陶瓷材料有一基礎的認識。課程進度將針對先進陶瓷材料的物理性質，由淺入深地、自陶瓷晶體的原子構造、玻璃陶瓷的原子結構，進而至微觀缺陷以及燒結微觀組織對陶瓷材料的物理性質之影響。期間有關陶瓷材料的機械、電性(含介電)及磁性等性質與上述結構和組織間的關係將儘量以舉例方式使同學易於了解。</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 modern ceramics with particular emphasis on inter-relating structure, property and application. The course is designed to start from the fundamentals in crystalline structure of ceramics, followed then by the microscopic defects that are critically important to the fascinating wide-range variety of ceramics physical properties. Extensive examples will be introduced in class to help students understand the underlying mechanism.</p>				
課程目標 (course objectives)	<p>(中)</p> <ol style="list-style-type: none"> 1. 熟悉基礎陶瓷材料的結構 2. 建立將工程陶瓷材料的結構與材料化學、微結構、與電性整合之能力 3. 培育將基礎陶瓷材料的結構應用至材料選用與微結構設計的知識 <p>(Eng.)</p> <ol style="list-style-type: none"> 1. Fundamental understanding in ceramic structures 2. Relate the ceramic structure to the chemistry, microstructure, and electronic behavior of modern engineering ceramics 3. Introductory overview of applying fundamentals to the ceramics selection and microstructure design 				
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)			



	材料科學導論					
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	Introduction		Demo some ceramic components
02	Ceramics structure (1)		
03	Ceramics structure (2)		
04	Ceramics processing and ceramic products		
05	Ceramic raw materials and characterizations		
06	Powder route – pre-forming processes (1)		
07	Powder route – pre-forming processes (2)		
08	Powder route – pre-forming processes (3)		
09	Powder route – dry and wet forming process (slip casting and rheology)		
10	Powder route – wet forming process: fundamentals in surface chemistry		
11	Powder route – wet forming process: fundamentals of interparticle forces in liquid		
12	Exam week	Midterm written exam	
13	Powder route – wet forming process: tape casting and other novel colloidal processes		
14	Powder route – wet forming process: injection molding and extrusion		
15	Powder route – post-forming processes		
16	Liquid route – sol gel, gel casting, etc.		
17	Vapor route – deposition methods, Sintering		
18	Exam week	Final written exam	
學習評量方式 (evaluation)			
Midterm Exam		35%	



Final Exam	35%	
Homeworks	10%	(One homework set in every other week typically.)
Term Paper	20%	

教科書 (書名、作者、書局、代理商、說明)
(textbook)

Ceramic Processing and Sintering, M. N. Rahaman, M. Dekker, 1995. (興大圖書館 電子書)

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.

Ceramic Processing, M. N. Rahaman, CRC, 2007. (國內代理：華通書坊)

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

課程教材 (教師個人網址請列在本校內之網址。)

(teaching aids & teacher's website)

Handouts and homework solutions are available on the instructor's webpage.



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 type="checkbox"/>	<input type="checkbox"/>	<input checked="" type="checkbox"/>	<input type="checkbox"/>	<input type="checkbox"/>
Introduction structure of ceramics: Atomic arrangement	1	1	1	0	0	0	0	0	0
Structure of ceramics: Stability of ionic crystals, the Madelung constant, and the Pauling's rule	1	1	1	0	0	0	0	0	0
No class on Tuesday (Moon Festival)	1	1	1	0	0	0	0	0	0
Structure of ceramics: FCC based structures	1	1	1	0	0	0	0	0	0
Structure of ceramics: HCP based structures	1	1	1	0	0	0	0	0	0
Structure of ceramics: Perovskite and its derivatives, covalent ceramics	1	1	1	0	0	0	0	0	0
Crystalline silicate and amorphous glass structure	1	1	1	0	0	0	0	0	0
Defects in ceramics: Point defects and Kroger-Vink notation	1	1	1	0	0	0	0	0	0
Defects in ceramics: Defect chemical reactions	1	1	1	0	0	0	0	0	0
Defects in ceramics: Electronic disorder	1	1	1	0	0	0	0	0	0
Defects in ceramics: Simultaneous defect equilibrium and the Brouwer diagram	1	1	1	0	0	0	0	0	0
Defects in ceramics: Special topics (e.g. SOFC fuel cells)	1	1	1	0	0	0	1	0	0
Defects in ceramics: Line and planar defects	1	1	1	0	0	0	0	0	0
Mass and electrical transport (I)	1	1	1	0	0	0	0	0	0
Mass and electrical transport (II)	1	1	1	0	0	0	1	0	0
Microstructure (I)	1	1	1	0	0	0	0	0	0
No class on Tuesday (Jan 1, 2008)	1	1	1	0	0	0	0	0	0
Microstructure (II)	1	1	1	0	0	0	0	0	0
總計(%)	100%	100%	100%	0%	0%	0%	10%	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。