

課程資訊 (Course Information)					
科號 Course Number		學分 Credit	3	人數限制 Size of Limit	30
中文名稱 Course Title	金屬奈米材料				
英文名稱 Course English Title	Metal Nanomaterials				
任課教師 Instructor	楊東翰(Yang, Tung-Han)				
上課時間 Time	T2T3T4	上課教室 Room			
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此科目對應之系所課程規畫所欲培養之核心能力 Core capability to be cultivated by this course	<ul style="list-style-type: none"> <li>■ 學習了解特定領域之專業知識之能力 (20%) The ability to learn the expertise in certain fields. (20%)</li> <li>■ 策劃及執行專題研究之能力。(10%) The ability to plan and execute research projects. (10%)</li> <li>□ 撰寫專業論文之能力。(%) The ability to write professional papers. (%)</li> <li>■ 創新思考及獨立解決問題之能力。(20%) The ability to think innovatively and solve problems independently. (20%)</li> <li>■ 不同領域人員協調整合之能力。(20%) The ability to coordinate people from different fields. (20%)</li> <li>■ 即時瞭解國際社會，產業及學術方向之能力。(30%) The ability to understand the global developments of society, industry, and academia. (30%)</li> <li>□ 領導、管理及規劃之能力。(%) The ability to lead, manage, and plan. (%)</li> <li>□ 終身自我學習成長之能力。(%) The ability of lifelong self-learning. (%)</li> </ul>				
課程簡述 (Brief course description)					
<p>This course covers the fundamentals of noble-metal nanomaterials and their chemistry. It emphasizes the chemical synthesis, characterization, and applications of noble-metal nanomaterials. Students will learn the nucleation and growth processes involved in the synthesis of noble-metal nanomaterials; the structure-dependent property of noble-metal nanomaterials; the major properties that include physical, chemical, and catalytic properties of noble-metal nanomaterials. Students will also undertake more in-depth courses in specialized areas within nanomaterial science and engineering.</p>					

## 課程大綱 (Syllabus)

Course keywords:

Metal nanomaterials; Nucleation Theory; Nanocrystal Structure and Property; Diffusion

### 一、課程說明(Course Description)

This course covers the fundamentals of noble-metal nanomaterials and their chemistry. It emphasizes the chemical synthesis, characterization, and applications of noble-metal nanomaterials. Students will learn the nucleation and growth processes involved in the synthesis of noble-metal nanomaterials; the structure-dependent property of noble-metal nanomaterials; the major properties that include physical, chemical, and catalytic properties of noble-metal nanomaterials. Students will also undertake more in-depth courses in specialized areas within nanomaterial science and engineering.

### 二、指定用書(Text Books)

none

### 三、參考書籍(References)

1. The Science and Design of Engineering Materials, James P. Schaffer, WCB/McGraw-Hill, 2nd Edition (1999)
2. Introductory Nanoscience: Physical and Chemical Concepts, Masaru Kuno, Garland Science; the first edition (August 19, 2011)
3. Nanostructures and Nanomaterials: Synthesis, Properties, and Applications, Guozhong Cao and Ying Wang, World Scientific, the 2nd edition (2011)
4. Recent research and review articles will also be given during the lecture

### 四、教學方式(Teaching Method)

In-class lectures

### 五、教學進度(Syllabus)

1. Introduction of Metal Nanomaterials
  - 1.1 Atomic scale structures; Crystal structures and properties
  - 1.2 Bonding, energy levels and bands in inorganic solids

1.3 Homogenous and heterogeneous nucleation of a phase

1.4 Metal Nanomaterials – surface facet and energy

1.5 Defects and atomic diffusion in metal nanomaterials

2. General Synthesis, Characterization, and Applications of Metal Nanomaterials

2.1 Top-down approach: fabrication of metal nanomaterials

2.2 Bottom-up approach: self-assembly of metal atoms

2.3 Light microscopy

2.4 Electron microscopy

2.5 Recent development of metal nanomaterials for emerging applications

3. Colloidal Synthesis, Characterization, and Applications of Metal Nanomaterials

3.1 Colloidal science and synthesis

3.2 Classical nucleation theory versus nano-classical nucleation theory

3.3 One-pot synthesis versus seed-mediated growth

3.4 Thermodynamic versus kinetic products

3.5 Classification of different types of seeds

3.6 Growth modes and patterns

3.7 The role of surface capping agent

3.8 Oxidative etching and galvanic replacement for controlled synthesis of hollow metal nanomaterials

3.9 Bi-, and multimetallic nanomaterials

3.10 Catalytic applications

六、成績考核(Evaluation)

Exam: 40%

Homework: 30%

Presentation: 30%

七、可連結之網頁位址