105 學年第 2 學期 有機金屬化學 Organometallic Chemistry 課程綱要

課程名稱：（中文）有機金屬化學 （英文）Organometallic Chemistry				開課單位	應化碩
				永久課號	IAC5540
授課教師： 王朝諺					
學分數	3	必/選修	選修	開課年級	*
先修科目或先備能力：					
課程概述與目標： The fundamental transition-metal and organic chemistry merge to produce organometallic chemistry, a major area in its own right. This course aims at providing students with an appreciation of the following: • A knowledge of ligand-to-metal bonding and related synthetic, and spectroscopic aspects. • An understanding of the fundamental types of organometallic reaction, such as insertion, oxidative addition, reductive elimination, oxidative coupling, nucleophilic addition and electrophilic addition and how these key reactions operate in various important catalytic and non-catalytic processes. • The basic knowledge, skills and experience useful to those students progressing into the chemical industry or into research in either inorganic co-ordination chemistry, organometallic chemistry, or organic synthesis. The course will also be useful to those students requiring a current awareness of this major branch of chemistry. • An ability to read and appreciate the current literature in this area.					
教科書（請註明書名、作者、出版社、出版年等資訊）	Organometallic Chemistry of the Transition Metals, Robert Crabtree, Wiley, Robert H. Crabtree, Fifth Edition				

課程大綱		分配時數				備註
單元主題	內容綱要	講授	示範	習作	其他	
The following outline is intended as a rough guide to the course. Subject to	• review of basic crystal field, ligand field, and M.O. theory • ligand bonding and metal-ligand interactions					

change! A. Basic bonding concepts and M.O. theory.	• π -donors: alkoxides and amides • π -acceptors: CO and ethylene • alkynes and cyclic systems: both π -donors and acceptors • allylic and cyclopentadienyl ligands					
B. Organometallic concepts, terminology and nomenclature.	• electron counting and the 18 electron (EAN) rule • neutral vs. charged counting schemes • formal oxidation states • relationship to M.O. theory • exceptions to the 18 e - rule: stable d 8 16 e - complexes • organometallic nomenclature					
C. Structure and Bonding of Organometallic Complexes	• Transition Metal Alkyls and Aryls • Metal Hydride Complexes and Other Related -Bonded Ligands • Metal Complexes of CO and Phosphine • -Bound Ligands such as Alkene and Alkyne complexes					
D. NMR spectroscopy and fluxional processes.	• chemical shift norms • heteronuclear NMR • characterization: case studies • fluxional processes: coalescence temperature and energy barriers • examples of fluxional processes: hapticity changes and rotational barriers					
E. Organometallic Reactions I: Reactions at the metal.	• ligand substitution • oxidative-addition • reductive-elimination					
F. Organometallic Reactions II: Reactions involving the ligands.	• insertion and deinsertion of unsaturated substrates • nucleophilic addition					

	• electrophilic reactions					
G. Industrial homogeneous catalysis.	• basic principles • hydroformylation • hydrogenation/isomerization of alkenes • Monsanto process • Wacker process • Ziegler-Natta polymerizations					
H. Alkylidenes (carbenes) and alkylidynes (carbynes).	• bonding and formation • nucleophilic vs. electrophilic alkylidenes • alkene metathesis					
I. Organometallics in organic synthesis.	• organometallics as protecting/activating groups • Pd catalyzed coupling reactions (Heck, Stille, Suzuki, etc.) • hydrozirconation • metal-based cyclization reactions					

教學要點概述：

1.學期作業、考試、評量

Attendance: 20 %

Midterm Exam, Quizzes and Reports: 40 %

Final Exam 40 %

2.教學方法及教學相關配合事項(如助教、網站或圖書及資料庫等)

	排定時間	地點	連絡方式
師生晤談	每週一 BCD	科學二館 203 教室	email: tgong@gate.sinica.edu.tw

每週進度表

週次	上課日期	課程進度、內容、主題

備註：

1. 其他欄包含參訪、專題演講等活動。

2. 請同學遵守智慧財產權觀念及勿使用不法影印教科書。

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