جامعة الملك عبدالله
للعلوم والتقنية
King Abdullah University of
Science and Technology

Course Syllabus: Photo and Electro Catalysis - ChemS 218

Division	Physical Science and Engineering Division
Course Number	ChemS 218
Course Title	Photo and Electro Catalysis
Academic Semester	Spring
Academic Year	2016/2017
Semester Start Date	01/22/2017
Semester End Date	05/18/2017
Class Schedule (Days & Time)	02:30 PM - 04:00 PM | Mon Wed

Instructor(s)

Name	Email	Phone	Office Location	Office Hours
Kazuhiro Takanabe	Kazuhiro.Takanabe@kaust.edu.sa	+966128080704	4274, 3, Ibn Sina (bldg. 3)	

Teaching Assistant(s)

Name	Email

Course Information

Comprehensive Course Description	The course "Photo and Electro Catalysis" offers highly advanced class that deals with the essence and advancement of heterogeneous catalysis, including electrocatalysis and photocatalysis. This course is designed for the students who are or will be developing expert knowledge in the field of heterogeneous catalysis. The lectures address principle of catalysis to discuss terminology, definition and efficiency. Solid catalyst surfaces provide reaction platform, in which the reactants adsorb, the adsorbates make chemical reactions, and the products desorb. Both gas and liquid reactions are possible and working principles at the surface are quite complex. Understanding of details in heterogeneous catalysis requires solid knowledge of physical chemistry, materials chemistry, characterization principle and practice, and solid state physics. The discussion continues on concept of chemical potential of the catalysts and gases/liquids, which determines thermodynamics and kinetics of the reactions. The classes also cover preparation and characterization of various classes of solid materials. The students will learn how to conduct kinetic analysis and to elucidate reaction mechanism at molecular scales. Examples of various practical applications of the catalysis and the catalysts are presented.
Course Description from Program Guide	Fundamentals of Photo and Electro catalysis presented with a novel approach for industrial applications
Goals and Objectives	In the field of photocatalysis and electrocatalysis, students will: 1. Understand basic principles of thermodynamics, kinetics, mass transfer, electron transfer and reaction mechanisms 2. Learn terminologies and concept of potentials and use them 3. Gain basic knowledge of solid state chemistry 4. Accurately describe and compare energy efficiencies of the materials and systems in photocatalysis and electrocatalysis 5. Acquire knowledge on the commercial application with used catalysts in the field of photocatalysis and electrocatalysis

Required Knowledge	Solid understanding of physical chemistry, and preferably materials science and solid-state physics.
Reference Texts	Spectroscopy in Catalysis; Niemantsverdriet; Wiley; 3rd; 2007; 978-3-527-31651-9 Molecular Heterogeneous Catalysis; van Santen, Neurock; Wiley; 1st; 2006; 978-3-527-29662-0 Chemical reaction engineering; Levenspiel; Wiley; 3rd; 1998; 978-0-471-25424-9 The Microkinetics of Heterogeneous Catalysis; Dumesic, et al.; ACS; 1st; 1993; 0-8412-2214-2 Modern Physical Organic Chemistry; Anslyn, Dougherty; Univ. Sci. books; 1st; 2006; 978-1-891389-31-3 Electrochemical Methods: Fundamentals and Applications; Bard, Faulkner; Wiley; 2nd; 2001; 978-0-471-04372-0 Concepts of Modern Catalysis and Kinetics; Chorkendorff, Niemantsverdriet; Wiley; 2nd; 2007; 978-3-527-31672-4 Modern Molecular photochemistry of organic molecules; Turro, et al.; Univ. Sci. books; 1st; 2010; 978-1-891389-25-2
Method of evaluation	**20.00**% - Quiz(zes) **20.00**% - Presentation **30.00**% - Midterm exam **30.00**% - Final exam
Nature of the assignments	Attendance + Quiz (20%) Report + Presentation (20%) Mid-term exam (30%) Final exam (30%)
Course Policies	Students are highly encouraged to attend classes. For exams, students are allowed to bring handouts with notes taken during the lectures. However, no textbook or other materials are brought to the exams. No make-up exams will be given without permission from the instructor.
Additional Information	

Tentative Course Schedule *(Time, topic/emphasis & resources)*		
Week	**Lectures**	**Topic**
1	Mon 01/23/2017 Wed 01/25/2017	Lecture 1
2	Mon 01/30/2017 Wed 02/01/2017	Lecture 2
3	Mon 02/06/2017 Wed 02/08/2017	Lecture 3
4	Mon 02/13/2017 Wed 02/15/2017	Lecture 4
5	Mon 02/20/2017 Wed 02/22/2017	Lecture 5
6	Mon 02/27/2017 Wed 03/01/2017	Lecture 6
7	Mon 03/06/2017 Wed 03/08/2017	Lecture 7
8	Mon 03/13/2017 Wed 03/15/2017	Lecture 8
9	Mon 03/20/2017 Wed 03/22/2017	Lecture 9
10	Mon 03/27/2017 Wed 03/29/2017	Lecture 10
11	Mon 04/03/2017 Wed 04/05/2017	Lecture 11
12	Mon 04/10/2017 Wed 04/12/2017	Lecture 12
13	Mon 04/17/2017 Wed 04/19/2017	Lecture 13
14	Mon 04/24/2017 Wed 04/26/2017	Lecture 14
15	Mon 05/01/2017 Wed 05/03/2017	Lecture 15
16	Mon 05/08/2017 Wed 05/10/2017	
17	Mon 05/15/2017 Wed 05/17/2017	
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Note

The instructor reserves the right to make changes to this syllabus as necessary.