Nanomaterials and Applications in Chemical Engineering

CENG 4540

3 credits

Lecture: Monday 16:30 -- 17:50 and Friday 12:00 -- 13:20 at Room 4504

Name: Prof. Yoonseob Kim

Email: yoonseobkim@ust.hk

Teaching Assistants: TBA

Course Description

This course handles the basics of nanomaterials and nanotechnology and how chemical engineers can understand the Nano and use them for daily product applications. Chemical engineers play a vital role in the development of nanomaterials having unique properties originating from its nanoscale confinement. Those nanomaterials are becoming core technology in daily products in the field of chemical engineering enabling much-enhanced performances. For example, the Nano-enabled lighter but durable bikes and airplanes, vibrant and accurate colors in display, cheaper and faster catalysts, precise and fast-responding sensors, tailor-made surface coatings, and better adsorption for purification etc. This course provides what students need to understand the fundamentals and applications of nanomaterials. We will put a higher importance on the science of nano, such as chemistry for synthesis and physics for the mechanism because, with a solid understanding of science, we can always become better engineers.

Required Texts and Materials

Lecture notes, readings will be posted on Canvas.

No official textbooks. Books students can refer to:

Introduction to Nanoscience and Nanotechnology. Chris Binns. 24 May 2010. Print ISBN:9780471776475, Online ISBN:9780470618837. DOI:10.1002/9780470618837. Copyright © 2010 John Wiley & Sons, Inc. PDF available through HKUST Library: https://onlinelibrary.wiley.com/doi/book/10.1002/9780470618837

Nanophysics and Nanotechnology: An Introduction to Modern Concepts in Nanoscience, Second Edition. Prof. Edward L. Wolf. 7 August 2006. Print ISBN:9783527406517. Online ISBN:9783527618972. DOI:10.1002/9783527618972. Copyright © 2006 WILEY-VCH Verlag GmbH & Co. KGaA. PDF available through HKUST Library: https://onlinelibrary.wiley.com/doi/book/10.1002/9783527618972

Expected Learning Outcomes

After this course, students should be able to

- apply principles of chemistry and physics to the novel nanotechnology and nanomaterials.
- understand the working principles of nanotools such as electron microscopy and probe microscopy etc.
- analyze our daily products that are using nanomaterials
- appreciate the role of nanotechnology for chemical engineers

Course Requirements and Policies

Lectures: The lectures will be interactive, having questions, quizzes, watching videos etc. Each class can start with a couple of quizzes, to remind essential concepts from the last class. Students are encouraged to participate in the classes through questions and discussions. Please be reminded that spending time on electronic devices, including mobile phones or other stuff, which can disturb classmates, should be avoided. In general, please take the rules seriously and follow them as a basic courtesy to the instructor and fellow students. We will not allow anyone to disrupt the learning of other students.

Quizzes: Classes will start with some quizzes through Canvas. You will be required to mark the answers and submit them to the Canvas.

Project: Many of our daily products use nanotechnology/nanomaterials for improved performance. The project involves self-learning on how nanomaterials are used in those products. Students will be required to do a literature search to understand underlying science that resulted in improved performance and compare them with other states of the art technologies. Students will deliver their learning outcomes to the group by giving a presentation. Presentation is a crucial way of delivering ideas. Both the instructor and peer students will evaluate the presentation. The latter is called peer-review. In the real world, after the school days, your performance is evaluated by peers. In this regard, it is an excellent opportunity to experience the peer-review system professionally, a.k.a. a constructive and encouraging way. Communication through writing is an essential way to be successful in the real world as well. Only clear, logical, and persuasive writing will make an impact on the general and broad audience.

Exams: Students will take one final examination.

Academic Integrity: Students should follow academic integrity rules: http://ugadmin.ust.hk/ug-guide/integrity/dishonesty.html. Please pay special attention to the offense of plagiarism, which involves claiming credit for others' work as if it is your own, e.g., copying the homework of classmates, using the information on the internet without referencing the source. Serious offenders will be referred to the University for disciplinary action.

Assessments:

Parts		**Points**	**Note**
Class participation		5	Students will get one point for each participation. Also, no matter how many times students participate in the same day, max points students can get per day is three points. To claim your points, email to the TA, copying YSK, noting your participation. At the end of the semester, the max score will be scaled down to five.
Quiz		30	Each quiz has equal weight for the total points. The lowest three scores will not be included in the points.
Project	Proposal	5	5 points: submitted on time with a good plan. 4 points: submitted on time, but it needs more work. 3 points: Hard to understand the intention of the proposal. Late submissions will be 50% off.
	Presentation	25	Evaluation: 20 points by YSK and 5 points by peers. *Individual project
Final Exam		35	Closed book.