

MSE 466, Spring 2022
Materials in Electrochemical Systems

Time: Tu/Th, 2:00–3:20 pm

Format: in-person (virtual in the first week)

- The in-person class will also be broadcasted live via zoom, to accommodate the needs of the students who may need to temporarily do virtual learning throughout the semester. Note that occasional disconnections and low audio quality may occur as the instructor walks around the classroom.
- Zoom link for the live lecture (also for virtual office hour):
(available in the syllabus posted on compass2g)
- Zoom cloud recording links will be posted here after each lecture (note: Cloud recordings will be deleted automatically after they have been stored for 30 days):
(available in the syllabus posted on compass2g)

Location: 206 Transportation Building

Website: compass2g

Instructor: Prof. Yingjie Zhang, yjz@illinois.edu

TA/grader: TBD

Office hour (virtual only): Thursday 3:30 pm – 4:30 pm

- Please use the same zoom link as the live lecture (see above). Occasionally I may not be able to join until ~4 pm. If you do not see me after joining the zoom, please send me an email.

Credit: 3 undergraduate or graduate hours

Course description: This course examines materials issues in electrochemical systems. It introduces fundamental thermodynamics and kinetics of electrochemical reactions, as well as materials design and processing for electrochemical energy storage and conversion systems. Of particular importance is the design of micro- and nano-structures and surfaces/interfaces of electrode materials for batteries, fuel cells, and supercapacitors. This course is intended for both undergraduate and graduate students.

Prerequisite: MSE 304 or any other courses that introduces the electronic structure of materials.

Textbook:

Allen J. Bard and Larry R. Faulkner, *Electrochemical Methods: Fundamentals and Applications*, 2nd Edition, Wiley & Sons, 2001. (ebook uploaded to compass2g – for this course only, avoid distribution outside this course)

Course Topics:

This course will integrate two aspects of electrochemistry. The first part relates to basic electrochemistry and electrochemical methods. The second will discuss specific electrochemical systems that are of interest to materials scientists and the importance of materials in those systems. The two will be integrated wherever appropriate.

1. Fundamentals of Electrochemistry

- Basics of electrochemical cells
- Thermodynamics of electrochemical reactions
- Kinetics of electrochemical reactions
- Mass transfer by migration and diffusion
- Potential sweep methods
- Electrochemical impedance spectroscopy

2. Materials Design and Processing in Electrochemical Systems

- Electrodeposition
- Electrocatalysis
- Fuel cells
- Supercapacitors
- Batteries

Grading:

Homework assignments	35%
Final project report	20%
Final project presentation	10%
Final exam (take home)	35%

Formats of assignments:

Homework, final project, and final exam will all be posted as "Assignment" in compass2g. They will need to be submitted electronically via compass2g by the deadline specified for each assignment. All of the submitted files need to be in pdf format. They can be either scanned from hand-written papers, or directly generated electronically. In any case, the submitted pdf files must be clearly legible, in order to receive proper grades.

Late policy:

Homework, final project report, and completed final exams turned in within 24 hours after the deadline will be given 50% score. After 24 hours past the deadline, 0% score will be given.

COVID-19 policy:

Please show your **Building Access Status in the Illinois app** or the **Boarding Pass** to the instructor every time you enter the classroom (206 Transportation Building). **Only the students whose Building Access Status says “Granted” will be allowed to join the classroom.**

All students, faculty, staff, and visitors are required to **wear face coverings in classrooms** and university spaces. This is in accordance with CDC guidance and University policy and expected in this class. Please refer to the University of Illinois Urbana-Champaign’s COVID-19 website for [further information on face coverings](#). **N95, KN95, and level 3 surgical masks are strongly recommended.**

Students who feel ill must not come to the in-person class. In addition, **students who test positive for COVID-19 or have had an exposure that requires testing and/or quarantine must not attend the in-person class.** The University will provide information to the instructor, in a manner that complies with privacy laws, about students in these latter categories. These students are judged to have excused absences for the class period and should contact the instructor via email about making up the work.

Students who fail to abide by these rules will first be asked to comply; if they refuse, they will be required to leave the classroom immediately. If a student is asked to leave the classroom, the non-compliant student will be judged to have an unexcused absence and reported to the Office for Student Conflict Resolution for disciplinary action. Accumulation of non-compliance complaints against a student may result in dismissal from the University.

Policy on conflicts or emergencies:

- (1) For time conflicts with other events (e.g. another scheduled exam), or an official UIUC activity (e.g. varsity athletics, band concert), please show official documentation about the conflict at least **one week** before the homework/report/exam due date. The due date will be extended if the excuses are legitimate.
- (2) If you will not be able to make it to the exam or submit HW on time due to serious illness or other emergent personal crisis (e.g. car accident) that are not described in (1), you must send an email to the instructor (yjz@illinois.edu) at your earliest convenience, and submit a statement from the professionals that are authorized to evaluate your situation (e.g. doctors, police officers). The statement needs to clearly explain that you are not physically capable of submitting the HW/report/exam on time. The due date will be extended if the excuses are legitimate.