

SYLLABUS
CHME478/578 Electrochemistry: Basics and Applications

Instructor:

Meng Zhou, Jett Hall 164, phone: 646-1516, e-mail: mzhou@nmsu.edu (preferred)

Office Hours:

Wednesdays and Thursdays, 4:00-5:30pm

Location and Schedule of the Course:

Tuesdays and Thursday 9 to 10:15am, JH259

Textbook:

There is no single textbook covering all topics for this course: for basic principles,

1. "Electrochemical Methods Fundamentals and Applications" 3rd edition by Allen J. Bard and Larry R. Faulkner (John Wiley & Sons, Inc. ISBN-13: 978-0471-04372-0).
2. "Introduction to Electrochemical Science and Engineering" by Serguei N. Lvov (CRC press, ISBN-13: 978-1466582859).

For applications, most of the materials will be the newly published papers (2015 to today) from the SCI journals. Copies of lecture notes and/or presentations will be made available to students enrolled.

Course Objectives:

The course will integrate theoretical studies with practical applications, the main goal is for students to understand the mechanisms responsible for electrochemical devices, realize the current progress and identify the problems hurdling the practical applications. We intend to provide a general overview on underlying electrochemistry concepts for various types of energy storage devices, with a few categories discussed in depth. While a course briefing is provided at the end of this syllabus, the actual content of the course is generally fairly flexible, depending on the interest and class participation of the students.

Course briefings:

1. Electrochemical Basics:
 - Introduction and overview of electrochemical cells and processes
 - Potential and thermodynamics of cells
 - Kinetics 1: current and overpotential
 - Kinetics 2: electron transfer theory
 - Mass transfer by migration and diffusion
 - Electrodes, cells and instrumentation
 - Bulk electrolysis methods
 - Cyclic Voltammetry
 - Rotating disc voltammetry
 - Double layer structure and adsorption
 - Electroactive layers and modified electrodes
2. Applications:
 - Lithium/Sodium Ion Battery: mechanism, current development and problems
 - Electrolyzer: H₂ production by water splitting at high and low temperature
 - Smart glass: electrochromic working mechanism, challenging

- Solar cell: working mechanism, testing methods and problems
- Fuel cell: H₂ fuel cell and solid oxide fuel cell.
- CO₂ capture, reduction and conversion.

Pre-requisites:

The class will focus on the basic concepts of electrochemistry and applications. The knowledge of thermodynamics, kinetics and transport will be applied, the instructor will go through these knowledge during the class, therefore, no pre-requisites. The class is applicable for both graduate and undergraduate students.

Grade Basis and Calculation:

Performance in the various categories of work will count toward the final grade as follows:

class attendance and participation: 20%

term paper: 50%

research presentation: 30%

The final letter grades are determined by the following percentage cutoffs:

94%: A+

76%: B+

50%: C

88%: A

70%: B

below 50%: F

82%: A-

64%: B-

Incomplete grades (I grade) will only be assigned if the student is unable to complete the course due to circumstances beyond the student's control. Complete information regarding the use of an *I grade* can be found at

<http://nmsu.smartcatalogiq.com/en/2014-2015/Undergraduate-Catalog/General-Information/Regulations/Incomplete-Grade>.

Class attendance and participation will be graded based on my impression of the quality and the extent of the participation in class. If, for a good reason (for example, illness, family emergency etc.), a student cannot attend all of the class meetings, he/she can discuss with me other arrangements to make up for class attendance and participation. Students who do not attend the course for an extended period will be dropped. Although there is no final exam, the class will meet at the scheduled exam time during finals week.

Term papers: Students are required to submit a written report on the topic of their presentation. Report will include a 2 page white paper (due middle of the semester) and a 5 page project narrative, which is due one week before the oral presentation.

Students are asked to give an ***oral presentation*** on a selected topic, which fits into the framework of this course by the end of the semester. The duration of the presentation should be about 20 minutes (15 minutes talk plus 5 minutes discussion). In general, students may need to look up suitable references themselves. Powerpoint or blackboard presentations are both acceptable. Presentations will be graded based on relevance to the course objectives, scientific content, presentation style & clarity.

Students with disabilities: If you have, or believe you have, a disability and would benefit from any accommodation(s), you may wish to self-identify. For any questions or accommodation needs in the classroom (all medical information is treated confidentially), contact:

Trudy Luken, Director

Student Accessibility Services (SAS) - Corbett Center, Rm. 208

Phone: (575) 646-6840 E-mail: sas@nmsu.edu

Website: <http://sas.nmsu.edu/>

If you have registered with SAS, please make sure that I receive a copy of the accommodation memorandum within the first two weeks of classes. It will be your responsibility to inform me or SAS representative (in a timely manner) if services/accommodations provided are not meeting your needs.

NMSU Discrimination Policy: NMSU policy prohibits discrimination on the basis of age, ancestry, color, disability, gender identity, genetic information, national origin, race, religion, retaliation, serious medical condition, sex, sexual orientation, spousal affiliation and protected veterans status.

Furthermore, Title IX prohibits sex discrimination to include sexual misconduct: sexual violence (sexual assault, rape), sexual harassment and retaliation. For more information on discrimination issues, Title IX, Campus SaVE Act, NMSU Policy Chapter 3.25, NMSU's complaint process, or to file a complaint contact:

Gerard Nevarez, Title IX Coordinator

Agustin Diaz, Title IX Deputy Coordinator

Office of Institutional Equity (OIE) - O'Loughlin House, 1130 University Avenue

Phone: (575) 646-3635 E-mail: equity@nmsu.edu

Website: <http://www.nmsu.edu/~eeo/>

Academic and non-academic misconduct: For a copy of the Academic Misconduct Policy, visit <http://www.nmsu.edu/vpsa/handbook.html>

Any form of cheating or plagiarism is prohibited, and (if caught) the particular work will be graded with a zero. Plagiarism is using another person's work without acknowledgment, making it appear to be one's own. Intentional and unintentional instances of plagiarism are considered instances of academic misconduct and are subject to disciplinary action such as failure on the assignment, failure of the course or dismissal from the university. The NMSU Library has more information and help on how to avoid plagiarism at <http://lib.nmsu.edu/plagiarism/>

Students should turn off cell phones and beepers while in class.

Excused Absences: If for a good reason, a student cannot make the due date for a homework assignment or misses an exam, the student should inform me beforehand in order to discuss other arrangement, if possible. If the student's absence is due to an emergency, the student has to contact me at the earliest possibility following that assignment. I will reserve the right to request proof for the occurrence of the emergency (doctor's excuse, police report etc.)

E-mail communication: For any e-mail communication with students, I will only use NMSU e-mail addresses. It should be noted that students can activate forwarding of their mail to any current-use e-mail address.

Other NMSU Resources:

NMSU Police Department:

(575) 646-3311

www.nmsupolice.com

NMSU Police Victim Services:

(575) 646-3424

NMSU Counseling Center:

(575) 646-2731

NMSU Dean of Students:

(575) 646-1722

For Any On-campus Emergencies:

911