ENCH 473 Electrochemical Energy Engineering
ENCH 648K Advanced Batteries and Fuel Cells
Spring 2014 Syllabus

Course: ENCH 473 Electrochemical Energy Engineering
ENCH: 648K Advanced Batteries and Fuel Cells
Semester: Spring 2014
Instructor: Chunsheng Wang
Lecture Day/Time: Tu/Th.3:30pm- 4:45pm
Location: **(JMP 3201)**
Office hours: Tu/Th. 1:30-3:30pm
Office: 1223A Chemical and Nuclear Building
Phone: (301)405-0352,
Email: cswang@umd.edu

TA: Mr. Tao Gao
TA: Office Hours: Tuesday, 12:30pm-1:30pm
Email: taogao@umd.edu

COURSE DESCRIPTION:
The lecture will start from the basic thermodynamics and kinetics of electrochemical reaction, with emphasis on the principle and performance of batteries, supercapacitors and fuel cells. The objective of the course is to give the students a solid foundation upon which they will be able to use the modern electrochemistry, fuel cell, battery and supercapacitor technologies into their research and career.

Recommended Texts:

1. Handbook of Batteries (3rd Edition), Edited by: Linden, D.; Reddy, T.B. © 2002 McGraw-Hill (go to http://www.knovel.com.proxy-um.researchport.umd.edu/web/portal/main, searching for Handbook of Batteries)
2. Advanced Batteries, Materials Science Aspects, Robert A. Huggins, Available online, http://www.springerlink.com/content/978-0-387-76423-8#section=172379&page=1&locus=22)
3. Fuel cell Systems Explained, 2nd Ed James Larminie and Andrew Dicks, John Wiley & Sons, Inc., 2003 (go to http://www.knovel.com.proxy-um.researchport.umd.edu/web/portal/main, searching for Fuel cell Systems Explained
4. Electrochemical Methods, 2nd Ed., A.J. Bard and L.R.Faulkner, John Wiley & Sons, Inc., 2001
5. Additional reference and supplemental material to be supplied via Blackboard.

Introduction
Electrochemical energy conversion (fuel cells) and storage (batteries and supercapacitors) are in massive and rapidly growing demand as the power source for portable devices,

electric vehicles and renewable energy storage. One critical issue to the success of EV/HEV and renewable energy is the use of electrochemical power sources such as batteries and fuel cells, which can convert chemical energy to electrical energy more efficiently and quietly than internal combustion engines. Today's college students are the future of the new electric vehicle and renewable energy industry and critical to achieving the vision of a sustainable energy. To engage students in engineering design issues related to the battery and fuel cell technologies, Dr. Wang create this new undergraduate/graduate course.

Objective: The objective of the course is to give the students a solid foundation upon which they will be able to use the modern electrochemistry, fuel cell, battery and supercapacitor technologies into their research and career.

Course Description and Content: The lecture will start from the basic thermodynamics and kinetics of electrochemical reaction, with emphasis on electroanalytical techniques, fundamental principle and performance of batteries, supercapacitors and fuel cells.

Course content:

1. Thermodynamics of electrochemical reaction
2. Kinetics of electrochemical reaction
3. Electroanalytical techniques
   Electrochemical impedance spectroscopy (EIS) and its application
   Cycling voltammetry and linear polarization
   Galvanostatic intermittent titration
4. Principle of battery
5. Li-ion batteries
6. Li-S and Li-air batteries
7. Flow batteries
8. Batteries for renewable energy storage
9. Principle of fuel cells
10. Proton exchange membrane fuel cell,
11. Alkaline fuel cell
12. Solid oxide fuel cell

Grading:
Home works=30%;
Midterm exam=25%,
Final exam=40%
Attendance: 5%

Final exam: TBD