

EML4930/EML6934: Li-ion Batteries, Spring 2021

Spring 2021

Instructor: Associate Professor, Dr. Katerina E. Aifantis
Lecture class: EML4930/EML6934
Office hours: 9-10 MW and by appointment in m zoom room
<https://ufl.zoom.us/j/4855871400>
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Textbook: High Energy Density Lithium Batteries: Materials, Engineering, Applications
by K.E. Aifantis, S.A. Hackney, R.V. Kumar, Wiley-VCH, ISBN-13: 978-3527324071

Course Description

Li-ion batteries are the most widely used energy sources for portable electronic devices, electric vehicles. Throughout this course the main quantities and reactions that characterize electrochemical cells will be described. The historical development of batteries, leading to Li-ion cells will be described and focus will be given on the components (anodes, cathodes, electrodes) of present and next-generation rechargeable Li-ion batteries. By the end of the course students will know how to use concepts from materials science, engineering and mechanics in order to develop design criteria for next generation Li-ion batteries that are to be used in portable electronic devices, electric vehicles, medical devices. In addition, Sodium-ion batteries, fuel cells, capacitors and hydrogen storage will also be covered.

Evaluation

3 Exams @ 15.66% each	47%
Project	23%
Homework/Labs	20%

Participation & attendance (lecture)

10%

Attendance

Students are expected to view all lectures, and to utilize office hours as needed. The instructor. For graduate students an in person lab visit is required by which they will view all the instruments used in fabricating and testing button cells.

Projects

The project will be a literature review on a topic of interest of the student, with the approval of the instructor. It will consist of a 20 min power point presentation for undergrads and 30 min for grads, along with a write-up of 2500 words for undergrads and 5000 for grads.

Tentative schedule for Spring 2021

(The instructor may change this schedule to accommodate class needs.)

Week 1 (Jan 11-Jan 15): Introduction to Electrochemical cells (Ch. 1, 2)

Quantities Characterizing Batteries

Week 2 (Jan 18-Jan 22): Quantities Characterizing Batteries (continued)

Li-ion battery technology-review of current state of art

Week 3 (Jan 25-Jan 29): Li-ion battery technology and Voltage Capacity Curves

HW1 Due Wed Jan 27

Week 4 (Feb 1-Feb 5): Voltage Capacity Curves (continued)

Exam 1 Feb 3

Week 5 (Feb 8-Feb 12): Cathode materials for Lithium ion battery (Ch. 5)

Anode materials for Lithium ion battery (Ch. 6)

Week 6 (Feb 15-Feb 19): Anode materials for Lithium ion battery (Ch. 6)

HW2 Due Wed Feb 17

Week 7 (Feb 22-Feb 26): Electrolytes for Lithium ion battery (Ch. 7)

Week 8 (Mar 1-Mar 5): Applications for Li-ion Batteries (Ch. 4)

HW3 Due Wed Mar 3

Week 9 (Mar 8-Mar 12): Lab Demos

Exam 2 Mar 10

Week 10 (Mar 15-Mar 19): Fuel Cells

Li-S batteries

Week 11 (Mar 22-Mar 26): Na-ion batteries

HW4 Due Wed Mar 24

Week 12 (Mar 29-Apr 2): Capacitors Flow batteries

Week 13 (Apr 5-Apr 9): Flow batteries

HW5 Due Wed Apr 7

Mg batteries

Week 14 (Apr 12-Apr 16): Lab Demos/Project presentations

Week 15 (Apr 19-Apr 21): Project presentations

Exam 3 April 21

Grading scale

94-100 A

89-93 A-

85-88 B+

80-84 B

77-79 B-

73-76 C+

68-72 C

66-67 C-

63-65 D+

59-62 D

0-58 E

For individuals in the gray area between two grades, performance on the homework and quizzes will be used to make the final decision.

Students Requiring Accommodations

Students with disabilities who experience learning barriers and would like to request academic accommodations should connect with the disability Resource Center by visiting <https://disability.ufl.edu/students/get-started/> ([Links to an external site.](#)). It is important for students to share their accommodation letter with their instructor and discuss their access needs, as early as possible in the semester.

Course Evaluation

Students are expected to provide professional and respectful feedback on the quality of instruction in this course by completing course evaluations online via GatorEvals. Guidance on how to give feedback in a professional and respectful manner is available at <https://gatorevals.aa.ufl.edu/students/> ([Links to an external site.](#)). Students will be notified when the evaluation period opens, and can complete evaluations through the email they receive from GatorEvals, in their Canvas course menu under GatorEvals, or via <https://ufl.bluera.com/ufl/> ([Links to an external site.](#)). Summaries of course evaluation results are available to students at <https://gatorevals.aa.ufl.edu/public-results/> ([Links to an external site.](#)).

University Honesty Policy

UF students are bound by The Honor Pledge which states, “We, the members of the University of Florida community, pledge to hold ourselves and our peers to the highest standards of honor and integrity by abiding by the Honor Code. On all work submitted for credit by students at the University of Florida, the following pledge is either required or implied: “On my honor, I have neither given nor received unauthorized aid in doing this assignment.” The Honor Code (<https://sccr.dso.ufl.edu/policies/student-honor-code-student-conduct-code/> ([Links to an external site.](#))) specifies a number of behaviors that are in violation of this code and the possible sanctions. Furthermore, you are obligated to report any condition that facilitates academic misconduct to appropriate personnel. If you have any questions or concerns, please consult with the instructor or TAs in this class.

Commitment to a Safe and Inclusive Learning Environment

The Herbert Wertheim College of Engineering values broad diversity within our community and is committed to individual and group empowerment, inclusion, and the elimination of discrimination. It is expected that every person in this class will treat one another with dignity and respect regardless of gender, sexuality, disability, age, socioeconomic status, ethnicity, race, and culture.

If you feel like your performance in class is being impacted by discrimination or harassment of any kind, please contact your instructor or any of the following:

- Your academic advisor or Graduate Program Coordinator
- Robin Bielling, Director of Human Resources, 352-392-0903, rbielling@eng.ufl.edu
- Curtis Taylor, Associate Dean of Student Affairs, 352-392-2177, taylor@eng.ufl.edu
- Toshikazu Nishida, Associate Dean of Academic Affairs, 352-392-0943, nishida@eng.ufl.edu

Software Use

All faculty, staff, and students of the University are required and expected to obey the laws and legal agreements governing software use. Failure to do so can lead to monetary damages and/or criminal penalties for the individual violator. Because such violations are also against University policies and rules, disciplinary action will be taken as appropriate. We, the members of the University of Florida community, pledge to uphold ourselves and our peers to the highest standards of honesty and integrity.

Student Privacy

There are federal laws protecting your privacy with regards to grades earned in courses and on individual assignments. For more information, please see: <https://registrar.ufl.edu/ferpa.html> (Links to an external site.)

Campus Resources:

Health and Wellness

U Matter, We Care:

Your well-being is important to the University of Florida. The U Matter, We Care initiative is committed to creating a culture of care on our campus by encouraging members of our community to look out for one another and to reach out for help if a member of our community is in need. If you or a friend is in distress, please contact umatter@ufl.edu so that the U Matter, We Care Team can reach out to the student in distress. A nighttime and weekend crisis counselor is available by phone at 352-392-1575. The U Matter, We Care Team can help connect students to the many other helping resources available including, but not limited to, Victim Advocates, Housing staff, and the Counseling and Wellness Center. Please remember that asking for help is a sign of strength. In case of emergency, call 9-1-1.

Counseling and Wellness Center: <http://www.counseling.ufl.edu/cwc> (Links to an external site.), and 392-1575; and the University Police Department: 392-1111 or 9-1-1 for emergencies.

Sexual Discrimination, Harassment, Assault, or Violence

If you or a friend has been subjected to sexual discrimination, sexual harassment, sexual assault, or violence contact the [Office of Title IX Compliance \(Links to an external site.\)](#), located at Yon Hall Room 427, 1908 Stadium Road, (352) 273-1094, title-ix@ufl.edu

Sexual Assault Recovery Services (SARS)

Student Health Care Center, 392-1161.

University Police Department at 392-1111 (or 9-1-1 for emergencies), or <http://www.police.ufl.edu/> (Links to an external site.).

Academic Resources

E-learning technical support, 352-392-4357 (select option 2) or e-mail to Learning-support@ufl.edu. <https://lss.at.ufl.edu/help.shtml> (Links to an external site.).

Career Resource Center, Reitz Union, 392-1601. Career assistance and counseling. <https://www.crc.ufl.edu/> (Links to an external site.).

Library Support, <http://cms.uflib.ufl.edu/ask> (Links to an external site.). Various ways to receive assistance with respect to using the libraries or finding resources.

Teaching Center, Broward Hall, 392-2010 or 392-6420. General study skills and tutoring. <https://teachingcenter.ufl.edu/> (Links to an external site.).

Writing Studio, 302 Tigert Hall, 846-1138. Help brainstorming, formatting, and writing papers. <https://writing.ufl.edu/writing-studio/> (Links to an external site.).

Student Complaints Campus: <https://care.dso.ufl.edu> (Links to an external site.).

On-Line Students Complaints: <http://www.distance.ufl.edu/student-complaint-process> (Links to an external site.).