EMA4450

Spring 2026

Instructor: Associate Professor, Dr. Katerina E. Aifantis

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Office hours: Wednesdays 12-2pm and by appointment

Zoom room: https://ufl.zoom.us/j/4855871400

Textbook is not required and material will be provided based on High Energy Density Lithium Batteries: Materials, Engineering, Applicationn 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.

For academic Policies and student help resources please see

https://go.ufl.edu/syllabuspolicies

Evaluation

3 Exams @ 25% each	75%
Project	10%

Homework	10%
Presentation	5%

Grading scale
95-100 A
90-94 A-
85-89 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

Project

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 10 min power point presentation, along with a write-up of 2000 words.

Homework policy

Homework is due at the beginning of class on the due date. The homework schedule is tentatively shown within the course outline. However, since the course schedule for each topic is dependent on class progress, the due date for each homework assignment is subject to change. Any homework changes will be posted on the Canvas class website. Students are responsible for checking Canvas and university email on a regular basis.

Attendance

Attendance is not required in the course. However, participation is expected and will be considered in rounding up final grades.

Tentative schedule for Spring 2026
(The instructor may change this schedule to accommodate class needs.)

Week 1 (Jan 12-Jan 16): Introduction to Electrochemical cells (Ch. 1, 2)

Week 2 (Jan 19-Jan 23): Quantities Characterizing Batteries (Ch. 1, 2)
Li-ion battery technology-review of current state of art

Week 3 (Jan 26-Jan 30): Li-ion battery technology

Week 4 (Feb 2-Feb 6): Electrolytes (Ch. 7)

HW1 Due Jan 28

Week 5 (Feb 9-Feb 13): Voltage Capacity Curves and Cathodes for Li-ion

Week 6 (Feb 16-Feb 20): Anode materials for Lithium ion batteries (Ch. 6)

Week 7 (Feb 23-Feb 27): Exam 1 and Anode Materials for Li-ion batteries

Exam 1 Feb 23

Week 8 (Mar 2-Mar 6): Applications for Li-ion Batteries (Ch. 4)

Week 9 (Mar 9-Mar 13): Fracture in Li-ion batteries

HW2 Due Mar 13

Week 10 (Mar 16-20) Spring Break

Week 11 (Mar 23-Mar 27): Li-S batteries and Exam 2

Exam 2 Mar 27

Week 12 (Mar 30-Apr 3): Li-S batteries

Week 13 (Apr 6-Apr 10): Na-ion batteries

Week 14 (Apr 13-Apr 17): Capacitors, Mg batteries

HW3 Due Apr 13

April 15, Exam 3

Week 15 (Apr 12-Apr 16): Project presentations