University of California at Berkeley
College of Engineering
Mechanical Engineering Department

ME138/238, Spring 2018 **Liwei Lin**

Lab #3
Assigned: Feb. 8th, 2018; Due: Feb. 27th (Tuesday)

Lab #3: Design, Fabrication & Assembly of a Supercapacitor

In this lab, we are going to conduct experiments to make a supercapacitor that can store electricity and deliver power. The substrate and electrolyte will be provided, and the size and configuration of the electrodes will be designed by you. You will then fabricate the electrodes, assemble the components to make a full supercapacitor. You will test it to obtain the capacitance and use the device to power a LED.

Before going to the lab:

(1) Please read through paper #4 carefully as lab #3 is based on the same material and fabrication process. Understand what a supercapacitor consist of and how it is assembled.
(2) Please design the pattern of your supercapacitor. Follow the instructions provided in class slides. In particular: (a) Draw your pattern using PowerPoint, and save the pattern as .jpg file. (b) Use black blocks to build the pattern, check the size, and limit all patterns within a 2" x 2" or 5cm x 5cm square, the smallest feature size should be no less than 0.02" or 0.5mm. (c) Email the original design pattern and illustration of how your device works to GSI before the lab.

In the lab:

(3) Go to 1113 Etcheverry at the time you are assigned and the GSI will comment on the designs and help you make modifications.
(4) Under the guidance of the GSI, please print out the designed electrode on the polymer substrate.
(5) Apply polymer-based electrolyte to the designed areas to complete the whole device.
(6) Please charge your supercapacitor (record the charge curve, V, I, t), and then use the charged supercapacitor to light up a LED (record the duration).

After the lab:

(7) Write an individual report about this lab, including introduction, your own design, experiment results, and discussions.

For Graduate Students:

(8) Conduct analytical and/or numerical simulations to study the design optimization of your supercapacitor, including how to maximize the energy capacity and how to minimize the impedance of the device.
(9) Discuss possible ways to power the LED for longer time using the fixed total area of the supercapacitor.
(10) Discuss possible ways to integrate such supercapacitors with energy harvesters.