Make a Supercapacitor Instructions

Introduction

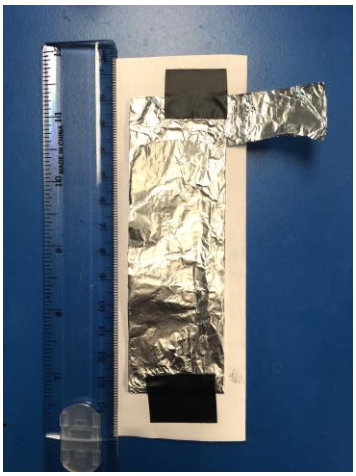
A conventional capacitor is a pair of thin conductive plates (such as metal) separated by a non-conductive (= insulating) material (such as paper). The plates can also be rolled up into a cylinder to increase the compactness. A supercapacitor is a relatively new type of capacitor that stores more energy, just like a battery, while charging/discharging faster than a battery.

In this activity, you will make a capacitor and a supercapacitor, and test their performance using a multimeter.

Materials you'll need (per person)

1. 2 x sheets of thin cardboard or printing paper
2. 2 x strips of aluminium foil
3. 1 x pair of scissors
4. 1 x plastic pipette
5. 1 x spatula or spoon
6. 1 x 100 mL beaker, 2 small vials
7. 1 x waterproof tape
7. Salty water
8. washing up liquid
9. Activated charcoal

Step 1: Prepare the electrodes



a) Cut some thin cardboard or printing paper into a rectangular piece.

b) Cut a piece of aluminium foil into the same shape as a) but slightly smaller.

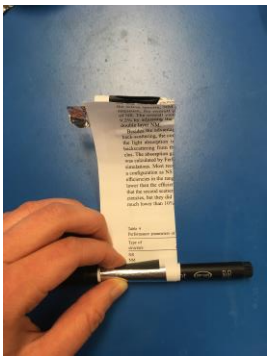
c) Stick the foil to the paper rectangle using some tape on the edges. Tear some of the foil on one of the edges (as in the photo) so you get a piece of foil sticking out of the paper. Now we have an **electrode**.

d) Repeat Steps a) to c) so you have two electrodes.

Step 2: Make a capacitor

a) Place one electrode on another so the layers will be stacked in the order of paper/foil/paper/foil.
Make sure the two foil rectangles are not touching each other!

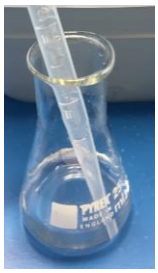
b) Roll the stacked electrodes into a cylinder using a pen as the core. Make sure the foil side is facing the outside. Wrap it as tightly as possible. Fix it with tape and remove the pen. Now you have a **capacitor**. Move on to **Step 7** for testing.

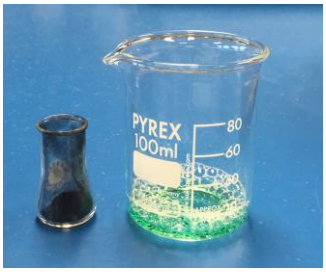


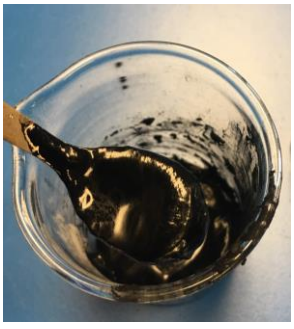
Step 3: Make the conducting paste

a) Take 3-4 teaspoonfuls of activated charcoal in a beaker.

b) Add drops of washing up liquid and salt water to the charcoal and stir well to make a thick carbon paste. Experiment the best ratio of each ingredient to get a consistency of peanut butter.







Step 4: Spread the paste

a) Repeat **Step 1** to make another set of two electrodes.

b) Spread the paste on top of the foil part of the two electrodes.

Step 5: Drop the electrolyte

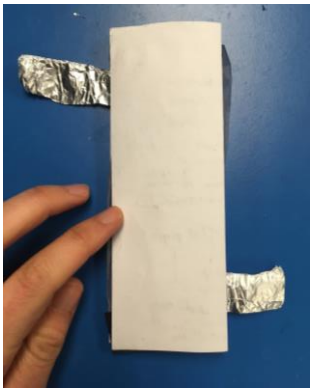
a) Cover one of the electrodes with a rectangular piece of tissue paper. Fix the edges with tape.

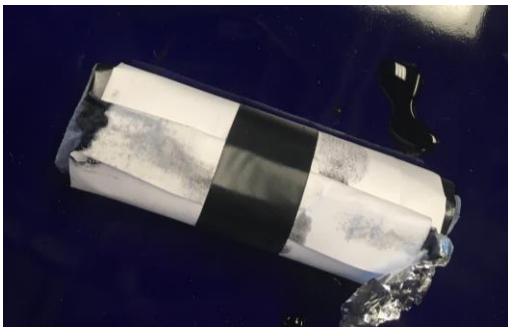
b) Drop the salt water (= electrolyte) on top of the tissue until the entire surface is wet.

Step 6: Make a supercapacitor

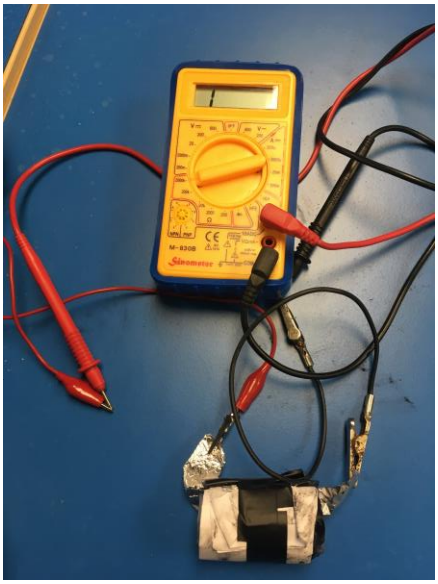
a) Assemble the two electrodes; this time the foil sides should be face to face. This means the final layers will be in the order of paper/foil/paste/tissue/paste/foil/paper.

b) Roll up the assembly following the same concept as in **Step 2 b)**. Finally, fix it with tape and you will now have a **supercapacitor**.





Step 7: Test your capacitor and supercapacitor



a) Connect the two foil ends to a multimeter.

b) Switch the dial to a resistance range of 2000k Ω. This will apply a certain voltage to the capacitor or supercapacitor.

c) Now switch it to the direct voltage range of 600 V and see the voltage response.

d) Repeat b) and c) but starting from 200 Ω this time.

e) You can also measure the response between 2000k Ω → 10 A and 200 Ω → 10 A.

f) Does the voltage/current response stay constant while measuring?

g) Do the values change if you apply the voltage for a longer time (~30 sec) before measuring the response?

h) Do you mark any differences between the responses of a capacitor and a supercapacitor? If so, why can that be? (clue: recall the way you made them)

Tidying up

The materials we have used today are not dangerous so you can use the bin for any rubbish:

a) Any spillages should be wiped up using paper towels.
b) Put all solid waste in the bin provided.
c) Liquid waste (salt water, detergent) can be poured in the sink.
d) Put all equipment back in its place.

- Thank you -