

If you ever opened up a battery or a supercapacitor, you would see that the electrodes, or material participating in charge storage, are typically film (paper-like) pieces of material. This tutorial reviews how you can make your very own supercapacitor.

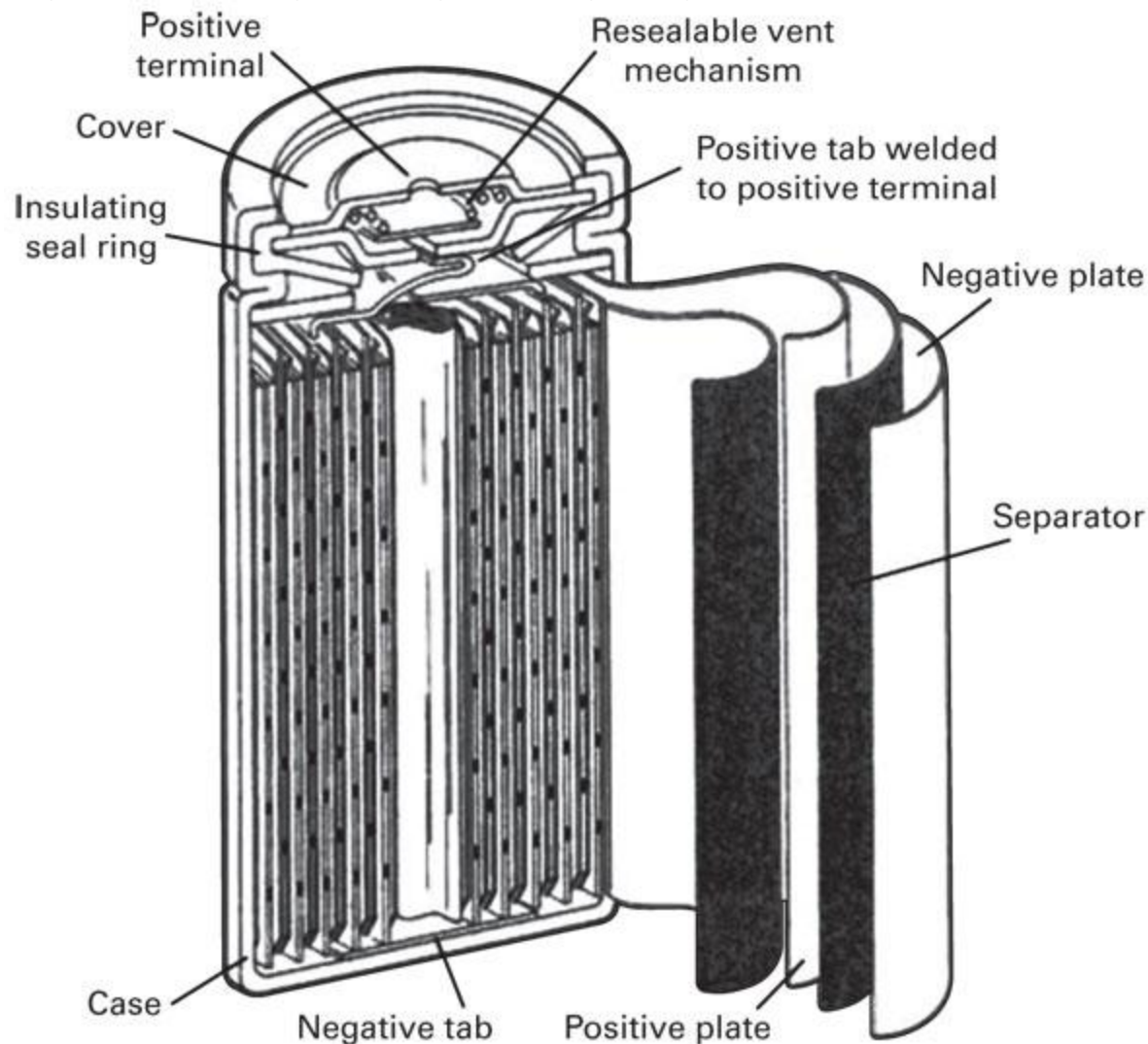


Fig 2. Cylindrical cells are constructed in "jellyroll" fashion, much like electrolytic capacitors.

# Film Electrode Protocol

## 1. Ingredients in a Supercapacitor

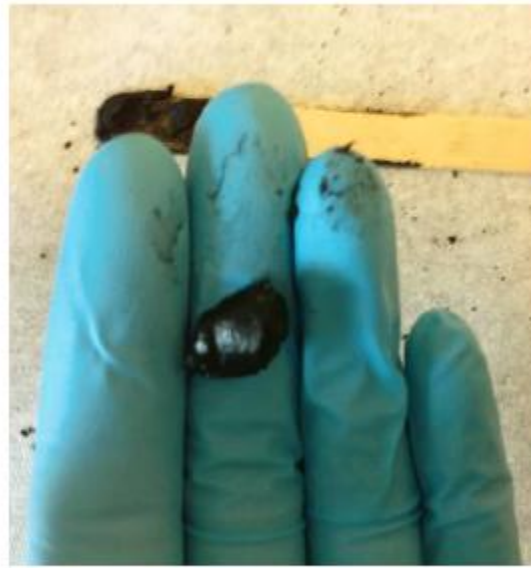


	Activated Carbon	Carbon Black	Aqueous PTFE
Role	Charge Storage	Ion/electron conductivity	Binder
Wt%	90%	5%	5%
	Surface area (SA) >1500 m <sup>2</sup> /g	SA <75 m <sup>2</sup> /g	

# Example Calculations



1. Start with total weight of solution=800 mg
2. Weigh:  $.90 \times 800 = 720$  mg of **Activated Carbon** (90% by wt)
3. Weigh:  $.05 \times 800 = 40$  mg of **Carbon Black** (5% by wt)
4. Our solution of PTFE is 60% weight—meaning in a 1 gram solution, 600 mg is actually PTFE, and the rest is water. We want 40 mg of PTFE so we need
  1.  $X \times 6/10 = 40$  mg
  2.  **$X = 66.6$  mg of PTFE**

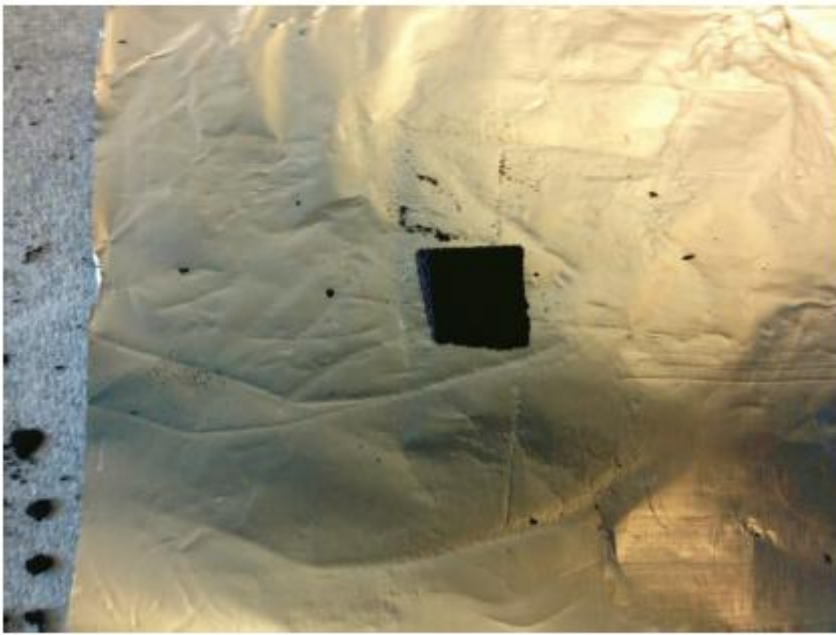


1. After you combine all your ingredients add about a gram of ethanol to make a solution
2. Place a small stir bar in vial
3. Place on heated stir plate, and heat until all ethanol is evaporated
4. You will be left with a mixture of dried carbon
5. Remove sample from vial, and mix with a mortar and pestal (like kneading dough), until all material can form a uniform ball (middle)

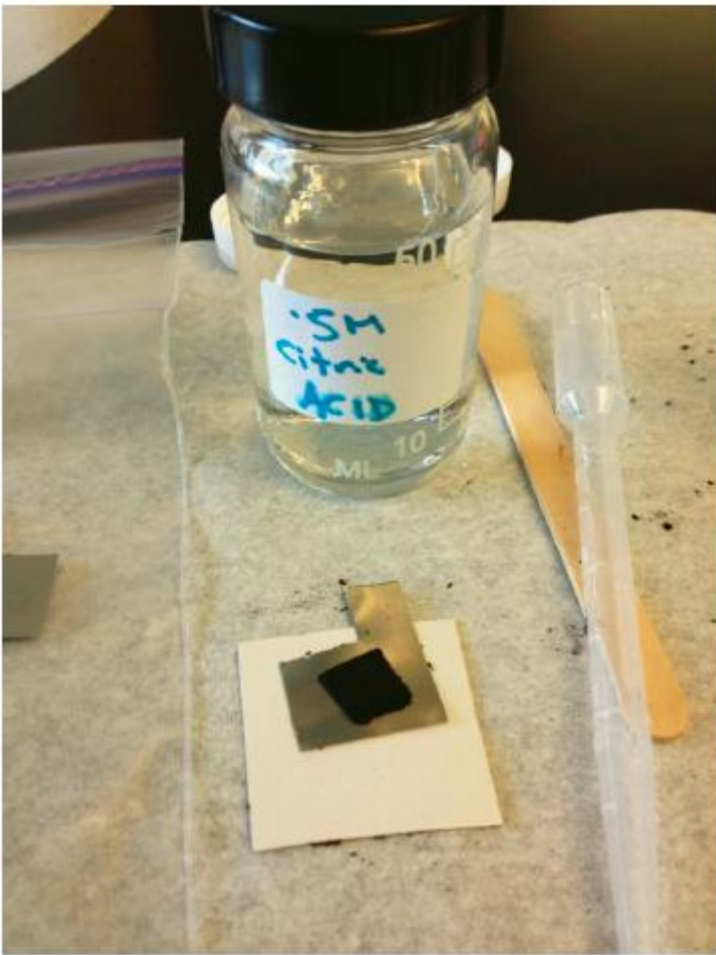




Place material on a glass plate, or tin foil, and roll out into a thin flat film.

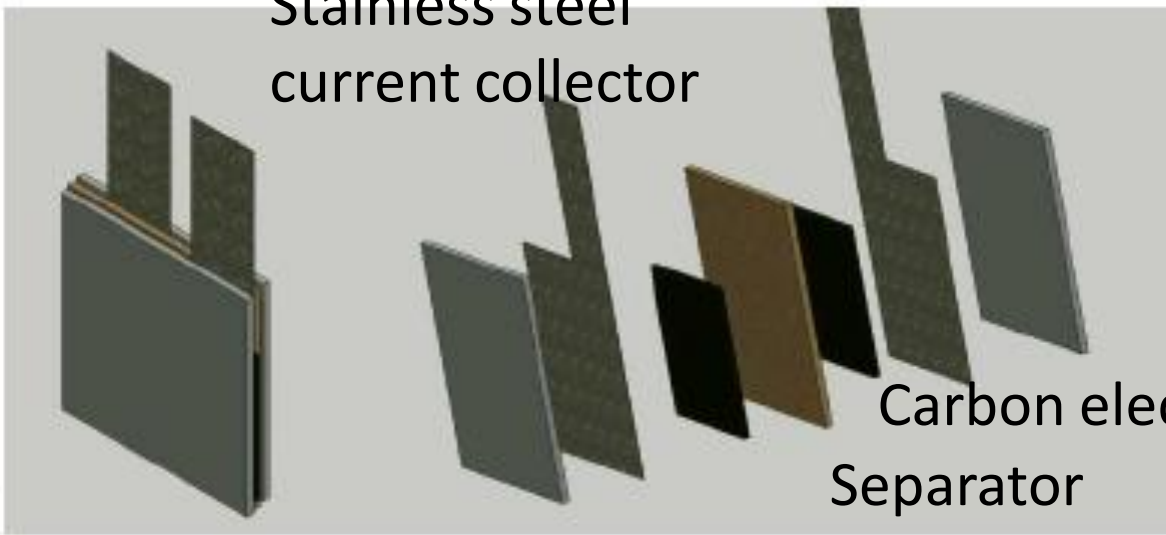


Cut electrode to desired shape (either a square with a razor blade, or you can punch circles for coin cells).



Basic example of assembly of a supercapacitor

Stainless steel  
current collector



Carbon electrode  
Separator

To assemble a basic supercapacitor, you place a carbon film on a current collector, apply a few drops of electrolyte (sodium sulfate, potassium hydroxide, etc.) and then place your separator on top of your electrode. The separator is usually celgard. Then place your other electrode on top in sandwich fashion, and finally your last current collector. Clamp for good contact, and you have a supercapacitor to be tested.



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