

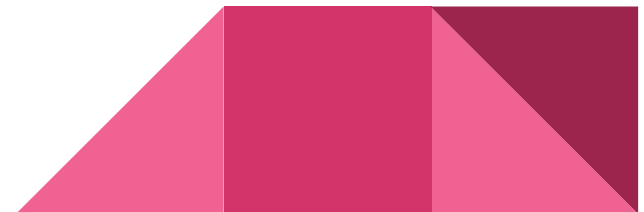


SUPERCAPACITORS

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History

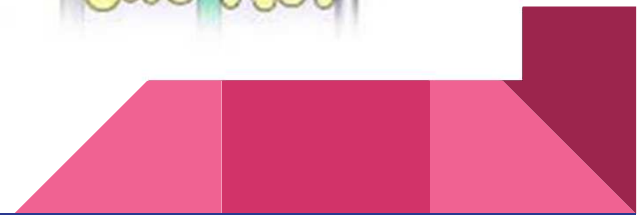
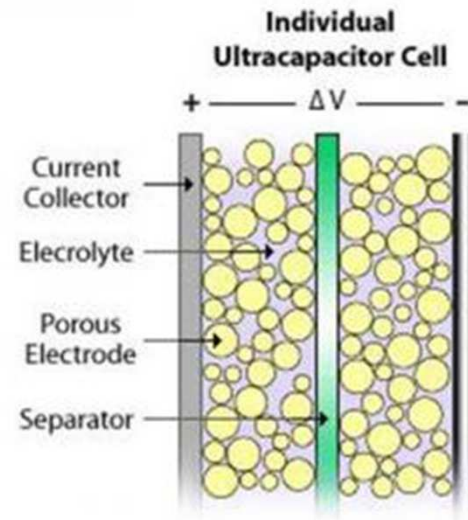
- Sustain a very high energy density
- H.E.Becker by General Electric in 1957
- Standard Oil of Ohio in 1969
- Conway in 1991
- 1998 by the Department of Energy of the United States



Design

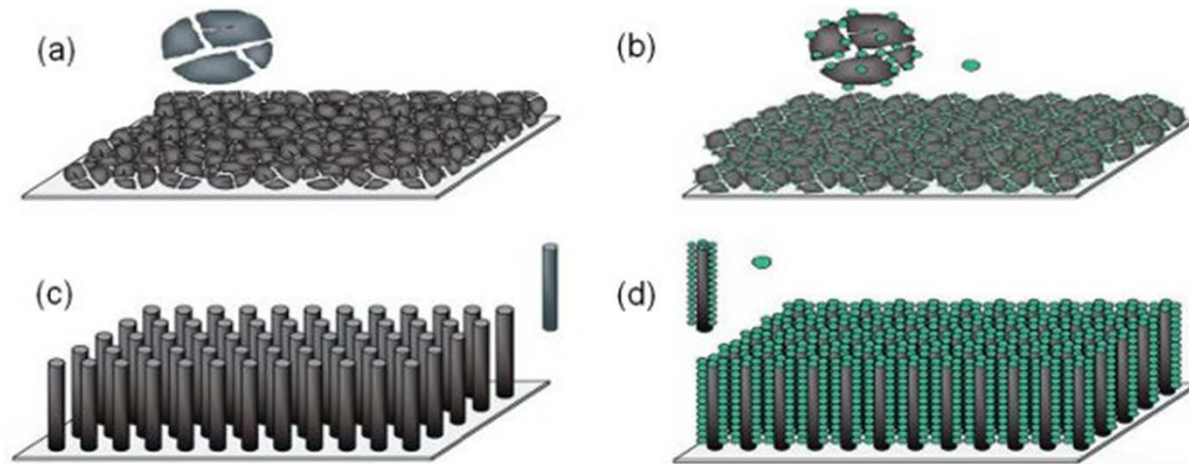
Supercapacitors are formed by pairs of conductive plates separated by a dielectric medium.

Their capacity is most influenced by the area of the plates. To increase it, you can increase its roughness or even provide porosity.



Design

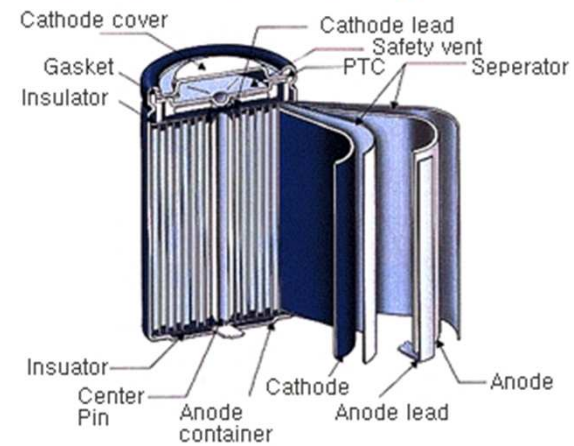
Strategies to improve both energy and power densities for supercapacitors. a, b, Decorating activated carbon grains (a) with pseudo-capacitive materials (b). c, d, Achieving conformal deposit of pseudo-capacitive materials (d) onto highly ordered high-surface-area carbon nanotubes (c).



Styles

- Different shapes

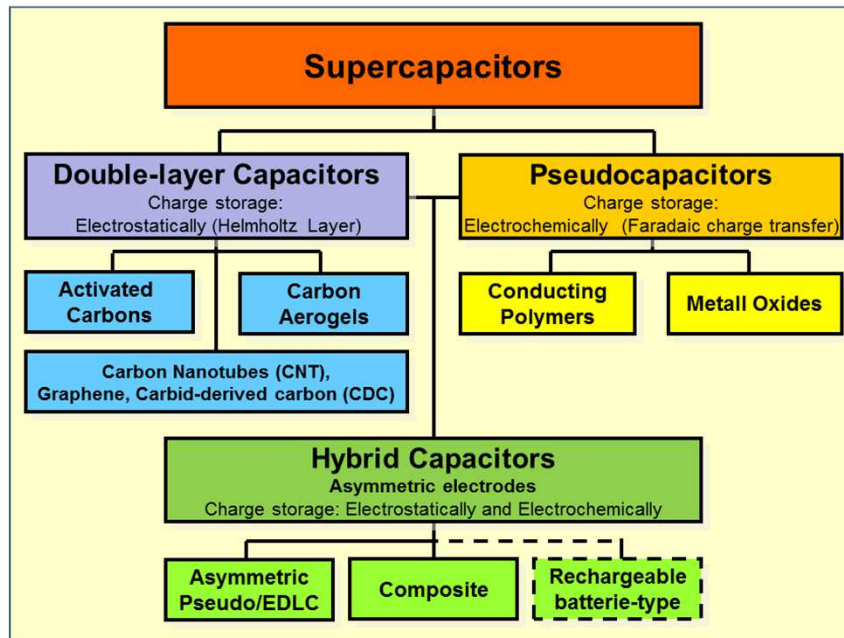
Structure of Lithium-ion Battery



- Construction: two metal foils coated, electrode material, ion-permeable membrane, electrolyte.



Supercapacitor Types



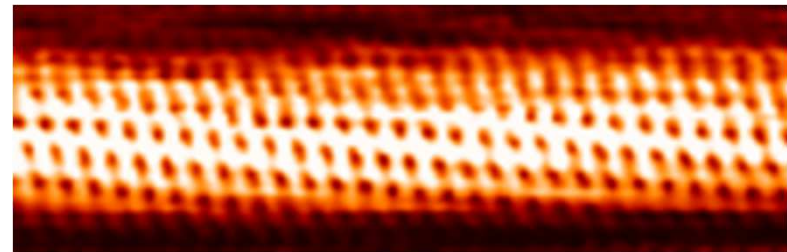
- Double-layer capacitors.
- Pseudocapacitors.
- Hybrid capacitors.



Materials

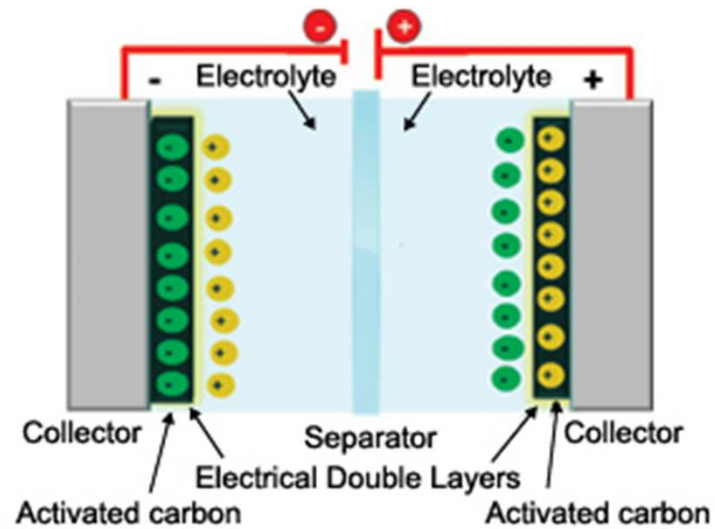
Electrodes

- High diversity of electrodes
- Activated carbon
- Carbon nanotubes
- Metal oxides



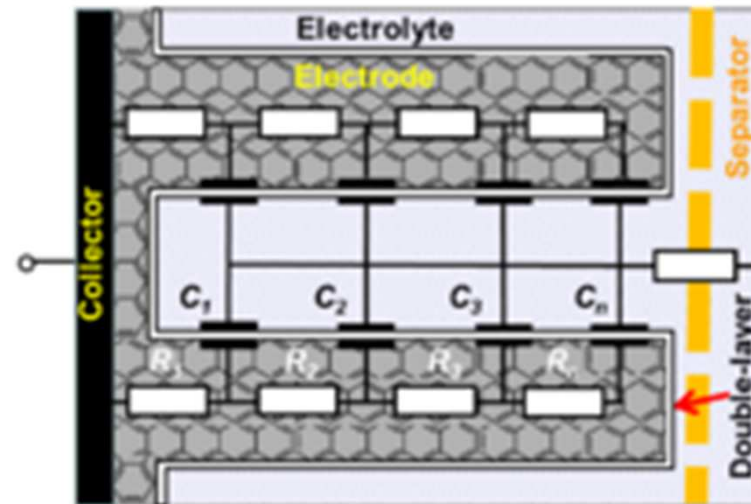
Materials

- Electrolytes
 - Aqueous
 - Organic
- Separators
- Collectors



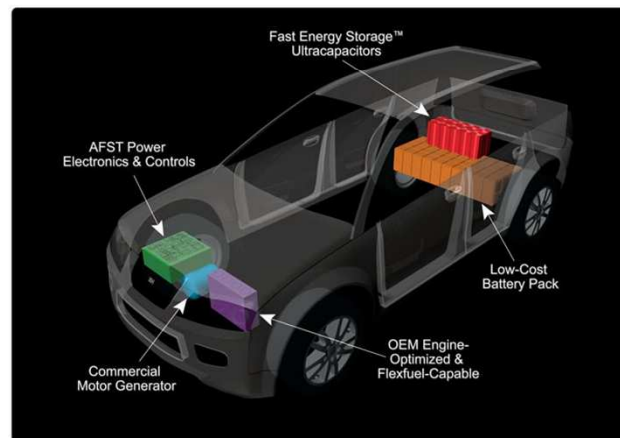
Electrical parameters

- Capacitance
- Operating voltage
- Internal resistance
- Current load
- Energy capacity
- Specific energy and power
- Lifetime



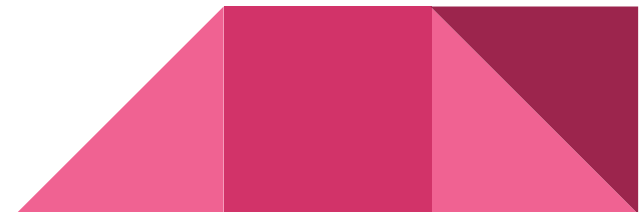
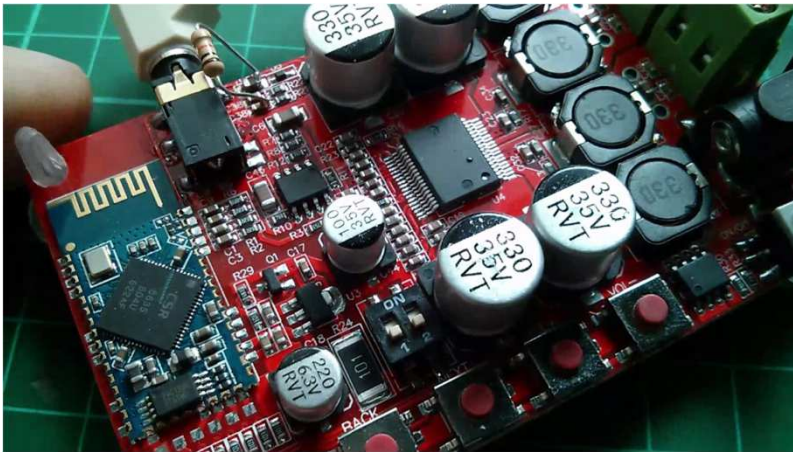
Applications

- Hybrid Cars
- Energy Support
- Energy Storage



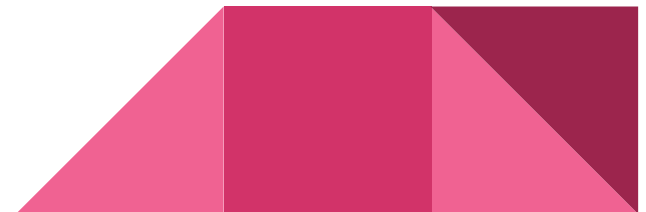
Applications

- Consumer Electronics



Applications

- Low-power equipment power buffer
- Transportation



THE END