Molecular Hypercapacitor Cell

Description

The Molecular Hypercapacitor Cell is a medium size member of the NANUM HCM family of energy storage devices having capacitance of 6000 Faraday and a voltage of 3.0 Volts. The family of these hypercapacitive devices is designed to support the latest trends in renewable energy, industrial electrification, and transportation. It can be used individually, integrated into a module assembly, or in a hybrid configuration. A characteristic of the HCM family is a cost-effective hypercapacitor with much more energy density per volume and per mass than existing supercapacitors, preserving all the benefits of energy storage in capacitors devices such as long life based on charge and discharge cycles and fast charging and discharging regimes.

Technology Overview

The development of hypercapacitor devices is based on a mesoscopic method, dealing with nanoscale properties (in which there are conventional electrostatic contributions plus those associated with the electronic structure). The mesoscopic methods therefore involve loading a molecular set of junctions in an electrochemical environment where both electrostatic and chemical capacitances have a contribution, but in which chemistry is preponderant and promotes the phenomenon of hypercapacitance.

Molecular hypercapacitors are chemical capacitors. The stored energy is not only associated with the spatial separation of charge in between the electrode and the molecular entities (electroactives) of the interface, but additionally it involves the energy associated to the electronic structure (atomic) of the molecular entities that form the active material of electrode. The quantized energy levels (associated with the boundary orbitals) of the electrically active molecular portions of the interface (electrochemical nano junctions) are essential when properly integrated with the macroscopic electrode. In this case, the integration of the molecules with the electrode is the key to the existence of this additional contribution that comprises quantum capacitive phenomena technology and that is the significant advancement over supercapacitors, achieved through new material selection and manufacturing techniques.

Hypercapacitor construction

A Molecular Hypercapacitor Cell, which is depicted in Figure 1, consists of positive and negative electrochemical cells (cathode and anode) that are wound and packed into a container filled with nonflammable electrolyte (salt/solvent). At the hypercapacitive molecular interface on the surface of the porous conductive electrode material, there are self-assembled electrochemical

nanocapacitors (formed by active redox molecules), which create interfaces that maximize interactions and electrochemical responses of the device, resulting in high capacitances.

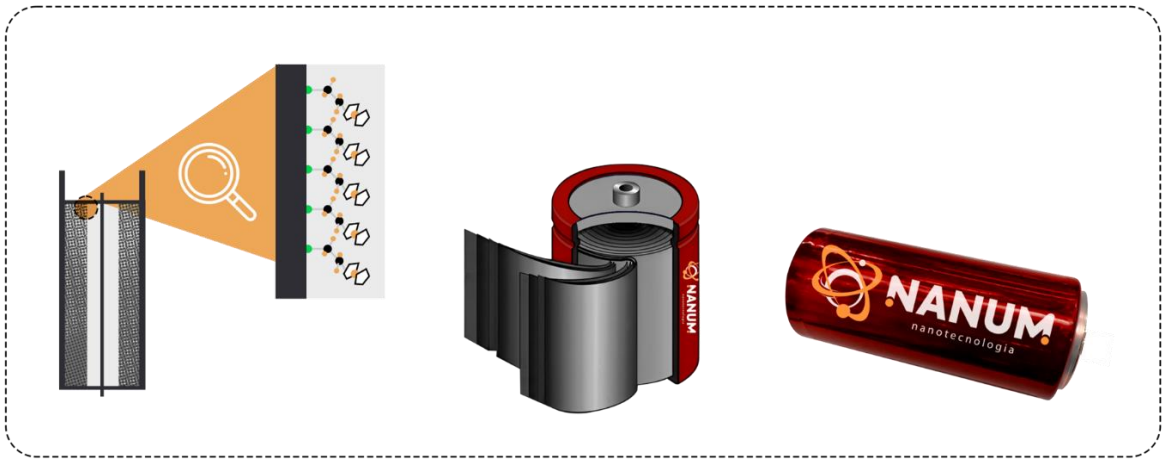

Figure 1 – Molecular Hypercapacitor Cell structure diagram.

Typical Properties

Rated Capacitance:	6000F
Equivalent Series Resistance (ESR):	0.20 mΩ
Maximum voltage:	3.0V
Specific power:	100 kW/kg
Specific energy:	20 Wh/kg
Mass (typical):	100 g
Volume:	0.13 L
Diameter:	46 mm
Length:	80 mm