TECHNOLOGY TRANSFER

Interest Exploratory Note

Supercapacitors

Indian Space Research Organisation (ISRO) at its Vikram Sarabhai Space Centre (VSSC) has developed the technology for processing Supercapacitors (2.5 V) of varying capacitance values viz., 5 F, 120 F, 350 F and 500 F for catering to specific applications related to Space and Societal needs.

Supercapacitors form a new class of electrochemical energy storage device poised to play an important role providing very high electric power boost demanded by applications. The beauty of this electrochemical component "Supercapacitor" is that it can be charged in seconds rather than hours; discharged as very high pulse current over million recharge cycles. Unlike batteries, it is environment friendly, maintenance free, efficiency level 98%, can operate at wide temperature range of - 40°C to + 70°C, it covers life span of 15 years without any quick ageing.

Operation and design: Conventional capacitor stores the electrical energy between two parallel plates by charge separation under the influence of electric field, whereas in super capacitor the charge is stored in an electrical double layer between electrode-electrolyte interfaces through oppositely charged ion adsorption in the interface manifested within Angstrom (Å) distance. Basic materials considered for processing such electrodes exhibit very large surface area (1500 – 3000 m2/g), paving way to achieve greater specific capacitance values (1-1000 F) along with high specific power. By this way, Super capacitors emerge to fill up the gap between conventional dielectric capacitors (for high power delivery) and batteries (for high energy supply). In addition, Supercapacitors are similar to batteries in design and configuration, but undergo charge and discharge operations continuously without significant degradation that batteries suffer.

Advantages: Supercapacitors can complement a primary energy source such as an internal combustion engine, fuel cell or a battery which cannot repeatedly provide quick bursts of high power. Using hybrid energy/power systems consisting of supercapacitors and battery in parallel, repeated pulse power needs can be met with, in which supercapacitor handles the peak power delivery while the battery provides sustained energy for load and recharging the supercapacitor. There will be significant advantage due to reduction of mass and size of battery as well as improved battery life and thus cost effective.

Applications

Aero Space: Delivery of peak/high pulse current for ignition systems, separation systems, actuators etc., Such high power capability envisages high power communication during interplanetary missions as well as in conventional electronics.

Department of Space has authorised NSIL for Technology Transfer of Supercapacitors to suitable entrepreneurs/ Industry in India. Interested Parties may please fill the enclosed form and send by email to contact-nsil@isro.gov.in

TECHNOLOGY TRANSFER

Interest Exploratory Note

Societal: Applications include automotive industry, hybrid transportation systems, grid stabilization, utility vehicles and rail-system power models. Supercapacitors could play an interesting role in consumer electronics powering electronic gadgets and cell phones to squeeze out extra energy and help a cell phone last longer.

Salient features of the systems (500 F typical)

1	Rated Capacitance	500 F
2	Maximum ESR DC, initial	2.5 mΩ
3	Rated Voltage	2.5 V
4	Absolute Maximum Voltage	2.7 V
5	Absolute Maximum Current	1000 A
6	Leakage Current at 25°C	5 mA
7	Maximum Stored Energy, (Wh/kg)	> 5.5
8	Specific Power, $_{Pmax}$	5.4 kW/kg
9	Short Circuit Current, typical (A)	600-700 A
10	Operating Temperature	-20 to 65°C

Currently, VSSC has established the technology in lab level with equipment such as electrode preparation, dry assembly and testing. Interested parties may scale-up the technology as per their market demands.

Department of Space has authorised NSIL for Technology Transfer of Supercapacitors to suitable entrepreneurs/ Industry in India. Interested Parties may please fill the enclosed form and send by email to contact-nsil@isro.gov.in