

SPACE POWER SYMPOSIUM (C3)
Small and Very Small Advanced Space Power Systems (4)

Author: Mr. Muhammad Alkali

Laboratory of Spacecraft Environment Interaction Engineering, Kyushu Institute of Technology, Japan

Mr. Motahata Takuya

Laboratory of Spacecraft Environment Interaction Engineering, Kyushu Institute of Technology Japan,
Japan

Prof. Mengu Cho

Kyushu Institute of Technology, Japan

Mr. Mohamed Yahia Edries

Laboratory of Spacecraft Environment Interaction Engineering, Kyushu Institute of Technology, Japan

Dr. Md Arifur Khan

Lab. of Spacecraft Environment Interaction Engineering, Japan

Dr. Hirokazu Masui

Kyushu Institute of Technology, Japan

PRELIMINARY STUDY OF ELECTRIC DOUBLE LAYER CAPACITOR AS AN ENERGY STORAGE
OF SIMPLE NANOSATELLITE POWER SYSTEM

Abstract

The spacecraft energy storage unit is designed to deliver electrical power during eclipse and / or serve as back-up in the event of technical anomalies in the supply of the bus system. In the space industries several types and kinds of conventional batteries such as NiMH, LIB, NiH₂ had been used and still in use all in the quest to optimize performance. Lessened weight, Life span, cost and performance are the key determinant in the selection of secondary source of electrical energy in Spacecraft Power Systems.

Electric Double Layer Capacitor (EDLC) is characterized by its desorption and adsorption of charged ions across the double layer that are formed at the electrodes which in turn generates high capacitance in comparison to the normal capacitors. Among the plus of this commercial-off-the shelf EDLC over conventional batteries include wide temperature range, safety, high cycle life, high power density in both charging and discharging. We are performing functional testing of the power system also utilizing equipments such as thermostatic / vacuum chambers in imposing thermal environment on the operating EDLC to simulate its performance in orbit by keying into the safety and wide temperature operability properties of electric double layer capacitors.

The focus of this paper include the ground-based testing for the verification of the applicability of electric double layer capacitor as energy storage unit for nanosatellite using the facilities of Centre for Nanosatellite Testing (CeNT) at Kyushu Institute of Technology (KYUTECH). Series of tests on these capacitors to serve as feasibility check on the capacitors shall be conducted. We show the substitute of EDLC for batteries as energy storage system in nanosatellite power.

Base on the development principle of nanosatellite which focuses on low-cost and short incubation duration using commercial-off-the shelf (COTS) components we designed, built and implemented a simple and easy-to handle electrical power system for nanosatellite using COTS electric double layer capacitor as the energy storage unit. The system is simple-to handle in the experimental set-up and also on the ground-testing that simulate real conditions as applicable in the orbit.

The testing shall be implemented adhering to dedicated guidelines and procedures with high consideration for safety. Power source, EDLC, with other functional parts of the electrical power system shall

be among the composition of the test bench(es) to be used in the simulation of the EDLC's performance as energy storage unit for spacecraft power system instead of the existing conventional batteries.