Development of New Structural Safety Designed Highly Compact 500F EDLC System

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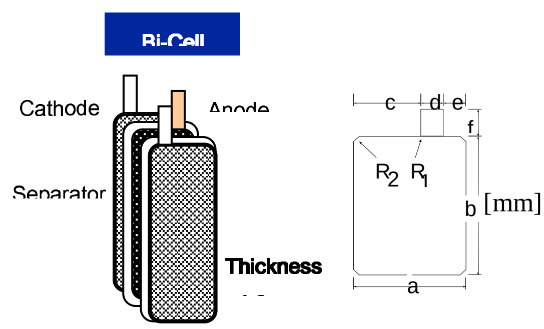
Supercapacitors are now being used in a number of applications, mostly as low-power devices for the purpose of memory data backup. Another high-power application is in telecommunications, where short, high power pulses are required. This move to higher power will continue and it is desirable to establish some supercapacitor specific testing procedures that will enable a valid comparison between different supercapacitor technologies.

In this work, we develop a large prototypes supercapacitor, and the presentation will present full characteristics, covering the practical aspects of manufacturing, as well as behavior in a wide range of conditions.For the compact designing of electrodes arrangement and suitable packaging, we introduce following process for the material. First, commercial activated carbon (Kureray, YP-17) was used and this was mixed with Super P conductive carbon, poly (vinylidene-hexafluoro-propylene) and NMP solvent. The slurry was homogenized with zirconia ball in mixer, and cast on a Al foil, using a blade methode. As a current collectors, we used aluminum foils. From the electrode-current collector laminated 6X4inch anode and cathode pieces were cut and bonded to 25um thick surface-modified micro-porous polyethylene separators (Teijin) by hot-lamination under pressure. The bi-cell structure was used, e.g. two cathodes shared one anode and its current collector, thus saving the weight of one current collector. PC-Net_4BF_4 electrolyte was injected in the cell, followed by sealing them. Formation and testing of the cells was performed on a Toyo battery cycler. After formation, cells were degassed and sealed. Impedance analysis was done with a Solatron.

Most of the cells described in this study were 500F 49mm thick prismatic units of 63mm X 95mm made of two bi-cell plates connected in paralled, such as the one shown on Fig. 1. The value of 500F was obtained as the average on the whole voltage range, while the maximun capacitance was measured showed about 1000F at 2.5V.On the left side of Fig.1 shows a structural image of supercapacitor and a cell schemes that we do make with real performance and will connected for large scale level for mass production. For this point, we have been done for the lithium polymer battery system last 5 years with mass fabrication processes. So we are trying to develop for the large capacitance supercapacitor system with compact size. The right side of Fig.1 shows that new designed types of cathode and anode with various sizes and thickness for portable supercapacitor which will mainly effective for the general demends or commercial uses as mentioned above for the lithium battery systems. The size of these electrodes will be determined by many electronics application and the thickness also will be one of the important factor to determine the capacity. These kindes of self-designed new model has been already tested in our laboratory ,as followings; with many real test for the commercial uses and back datas with final qualified best compact conditions which can be applied for those preparation conditions of high power density with compact design type. The discharge voltage profile of a prototype cell at currents ranging from 0.1V to 2.5V is shown Fig. 2. From this Figure, our designed proto type cell(AC-AC)(a) shows 8 times larger capacity ,400mAh/g, than the general commercial capacitors(AC-LiCoO2)(d) or EDLC. At this point, we also could obtained large capacitance(>800F) than expected. But we need many demanded real tests for mass production which will be mainly effected for the quality of compact capacitor system. And also we measured the impedance test for the surface conductivity. From these results, the surface conductivity contains very high expectable conductivity as much as small small definite semi-circle of inner resistance for self designed supercapacitor prototype cell. We will present also the other related data which can be needed for the compact type supercapacitor with the mass fabrication.



	Cathode	Anode (mm)
a	57.5±0.1	57.5±0.1
b	86.0±0.1	86±0.1
c	37.7±0.1	37.7±0.1
d	10.0±0.1	10.0±0.1
e	9.7±0.1	9.8±0.1
f	8.0±0.1	8.0±0.1
R_1	1.0±0.1	1.0±0.1
R_2	2.0±0.1	2.0±0.1

Fig. 1. Electrode designs of effective compact sizes

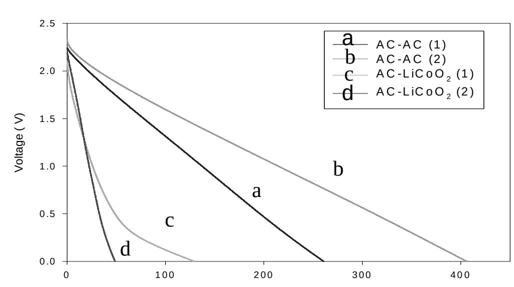


Fig. 2. Charge-discharge curves of different electrode materials for compact supercapacitors

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