Reduced graphene oxide incorporated Carbon aerogel as capacitive electrode of Lithium Ion Capacitor

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Abstract

Replacing one capacitive electrode of a Supercapacitor with a lithium ion battery electrode is an effective approach for generation of advanced hybrid energy storage device called Lithium Ion Capacitor (LIC) having wider cell voltage (3.8 V) and higher energy density suitable for upcoming energy storage applications [1]. Conventional LIC uses high surface area activated carbon as capacitive electrode and graphite as anode [2]. Carbon aerogel is three dimensional nanostructured mesoporous carbon material which possess better energy storage capabilities due to its high surface area and tuned porosity. Reduced graphene oxide (RGO) is considered as an additive for improving the electrochemical performance of capacitive electrodes [3]. This study describes method of fabrication of LIC with reduced graphene oxide incorporated carbon aerogel as capacitive electrode of LIC. Aqueous dispersion of graphene oxide was mixed with carbon aerogel precursor solutions and formed homogeneous gel was super critically dried and converted into reduced graphene oxide incorporated carbon aerogel after inert atmosphere heat treatment. Graphite//carbon aerogel LIC pouch cell fabricated with RGO incorporated carbon aerogel as capacitive electrode, graphite as battery electrode and $LIPF_6$ as electrolyte. Electrochemical performance of LIC pouch cell was tested by Galvanostatic charge/discharge method and Cyclic voltammetry after completing the prelithiation step. LIC pouch cell successfully cycled up to 8000 cycles without much degradation in performance and achieved specific energy up to 61 Wh/Kg and specific power up to 6 Kw/Kg. Demonstration LIC pouch cell carried out by lighting LED bulb array.

References

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[2]. George Z Chen, International Material Reviews,62, 2017,173-202
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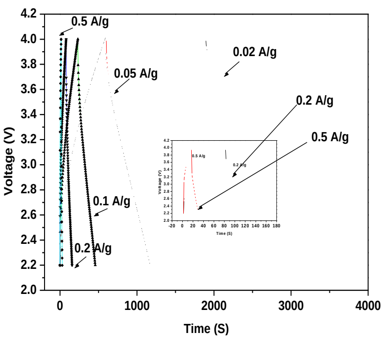
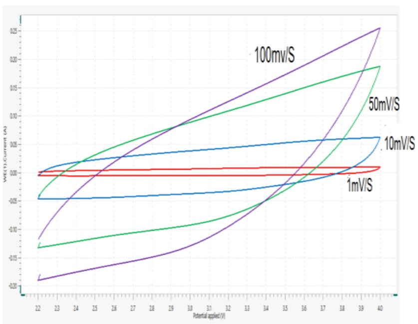


1 (a)



1(b)

1(c)

Fig. I(a) Charge discharge curves of LIC, **1(b)** CV plot of LIC and **(1c)** Lighting of LED arary using developed LIC pouch cell