CARBON 2019
LEXINGTON, KY

MANUFACTURE OF CARBON COMPOSITE ELECTRODES FOR SUPERCAPACITORS

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Introduction

In this study, the carbon-based materials that are spotlighted as the next generation of energy materials are to be applied to super capacitors manufacturing. For this purpose, graphene oxide was synthesized.
In addition, it is intended to improve the usability and storage efficiency of the energy storage device as a fabric type by filling and reducing carbon nanofibers by electrospinning.

Materials and Methods

For the synthesis of oxidized graphene, 50 mL of an aqueous solution, 10 g of $K_2S_2O_8$, and 10 g of P_2S_5 were added and stirred. Then, 10 g of graphite was added and further stirred. The oxidized graphite powder was obtained through filtration, neutralized with secondary distilled water, and dried. The dried powder was added to 460 mL of sulfuric acid aqueous solution as $KMnO_4$, stirred and filtered.
After dispersing in secondary distilled water, 50mL of H_2O_2 was added, and the mixture was washed and lyophilized to complete the synthesis.
For electrode preparation, 50 mg of synthesized graphene oxide was added to and dispersed in 9g of DMF, and 0.9g of PAN powder was added to the solution for further dispersion.
This was spun at a voltage of 12kV and a discharge rate of 0.8 mL/hr, stabilized at 280°C and carbonized at 1000°C to finally produce an electrode test piece.

Results and Discussion

The electrochemical measurement was performed by using a three-electrode method using Pt as a counter electrode and Ag/AgCl as a reference electrode, and a 1M KOH solution was used as an electrolyte.
All electrodes were circulated 10 times at a scanning rate of 20mV/s for stabilization, and then compared with the conventional test specimens and general PAN-based carbonized test specimens.
The shape of the current density was close to the rectangular shape according to the scanning speed of both test specimens.
It was confirmed that the electrochemical reversibility was excellent and the area of the specimen to which graphene oxide was added at the same current density was larger.
In addition, the test piece to which graphene oxide was added under the condition of a current density of 1A/g showed a higher effective filling capacity than a general PAN type test piece.

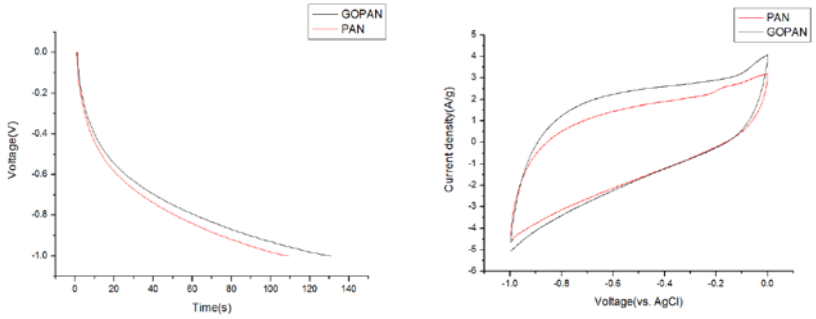

Figure 1 (a) Cy clic Voltammograms (scan rate of 50mV/s) (b) Galvanostatic Charge-Discharge Curves (Current Density of 1A/g)

Conclusions

Finally, in the case of the test convenience in the form of dispersion of graphene particles in the carbon nanofibers, the general pan-based carbon nano-fiber test piece compared with about 1.2 times the effective charge capacity was obtained after the additional study it can be expected to improve its efficiency.

Acknowledgment

This research was supported by Basic Science Research Program through the National Research Foundation of Korea(NRF) funded by the Ministry of Education(No. 2016R1A6A1A03012069) (No. 2017R1D1A1B03028413)

References

1. Borenstein. A., Hanna. O., Attias. Ran., Luski. Shalom., Brousse. Thierry., Aurbach. D. (2017). Carbon-based Composite Materials for Supercapacitor. *Journal of Materials Chemistry A.* 25

1. Kumar. S., Krishna. Bhat. D., Manish Aggarwal. A., S. lyer. P. (2010). Nano ZnO-Activated Carbon Composite Electrodes for Supercapacitors. *Pysica B Condensed Matter.405. 2286-2289*