

수열 합성법을 이용한 구형 탄소의 제조 및 특성 평가

Fabrication of Carbon Spheres by hydrothermal synthesis and evaluation of characteristics

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Abstract : The electric double-layer capacitors (EDLCs) are consisted of electrodes, electrolyte and separator. Among of them, electrode materials are generally used carbon materials. In this study, we experimented for the purpose of fabrication of carbon spheres from various carbohydrates as electrode material. Carbon spheres were prepared by hydrothermal synthesis process. Carbon spheres' morphology had been examined using scanning electron microscopy (SEM) and specific surface area had been examined using BET analysis. To confirm the possibilities of carbon spheres as EDLC's electrode materials, we conducted electrochemical tests such as cyclic voltammetry (CV), impedance and cycle ability.

1. Introduction

The electric double-layer capacitors (EDLCs) are device that using the charge stored in the electric double-layer that generated between the electrolyte and the solid electrode. EDLCs are consisted of electrodes (cathode, anode), electrolyte and separator. Among of them, electrode materials are generally used carbon materials. Carbon spheres as a new material is becoming an attractive research field due to its potential applications such as catalyst supports, drug delivery, lithium-ion secondary batteries, and energy storage medium. Carbon spheres synthesized various techniques, such as hydrothermal synthesis, chemical vapor deposition, and pressure carbonization. In this study, we experimented for the purpose of fabrication of carbon spheres using a variety of carbohydrates as electrode material by alternative measure because carbohydrates are inexpensive materials and the most abundant biopolymer in nature. Especially, we selected starch as precursor because it is typical natural carbohydrate being in rich in carbon and can be obtained from various renewable plant resources. The biggest merit is that starch is one of the cheapest and the most abundant biopolymer.

2. Main Subject

Carbon spheres were prepared by hydrothermal synthesis process. First, carbohydrate (starch) was carbonized by hydrothermal method using autoclave. Experimental parameters are temperature, concentration, duration. Next, obtained carbon spheres were washing with distilled water, ethanol and filtering. Finally, obtained samples were dried oven at 80°C. Carbon spheres' morphology had been examined using scanning electron microscopy (SEM) and specific surface area had been examined using BET analysis. To confirm the possibilities of carbon spheres as electrode materials, we conducted electrochemical tests such as impedance for measuring capacitors' resistance, cyclic voltammetry (CV) for confirming capacitance and cycle ability.

Table 1. Process parameters

Parameters	Tempaerature	Unit
Temperature	160 - 220	°C
Duration	2 - 12	Hour

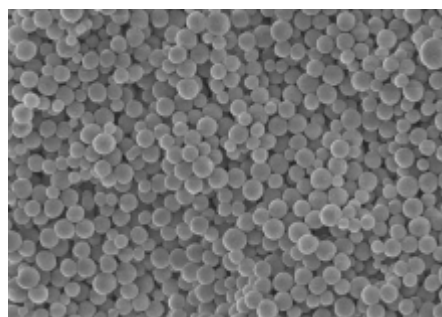


Fig. 1. SEM images of ynthesized carbon spheres.

3. Conclusion

I studied fabrication of carbon spheres by various carbohydrates. We confirmed several results. The size and morphology of carbon spheres' were controlled using experimental parameters. As increasing of temperature, carbon spheres' diameters were decreased and increasing of duration, carbon spheres' diameters were decreased. Glucose appeared nano-sized morphology, but starch appeared micro-sized morphology. Resultingly, starch-based carbon spheres were the best sample for application of electric double-layer capacitor's electrode materials. And carbon spheres were required that surface reforming process. After surface reforming, carbon spheres will be able to apply the electrodes materials.

Reference

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