Electrochemical Properties of Carbon Materials for Electrical Double Layer Capacitors

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Electrical double layer capacitors (EDLCs) have been used as small-scale energy storage devices in stationary electronics such as memory back-up devices and solar batteries. In this research, EDLCs were fabricated using single-walled carbon nanotubes (SWNTs) and polymer binder (PVDF). We have investigated the key factors determining the performance of these EDLCs. The binder was heat-treated at 900℃ for 30 minutes under argon atmosphere. We performed BET, cyclic voltammetry and AC impedance analysis to evaluate electrochemical properties of EDLCs. The specific surface area of SWNTs and PVDF before heat treatment was 132 and 18 m^2/g, respectively. After the heat treatment of electrode materials, however, the specific surface area of them increased to 357 and 997 m^2/g, respectively. We also observed that the cyclic voltammograms showed more rectangular shape after heat treatment and the contact resistance between the current collector and electrode materials decreased dramatically. This phenomenon is mostly attributed to the effect of heat treatment of PVDF. We found that SWNTs played important role for the improvement of electrodynamic property by giving conducting paths to the electrodes.