

## Applications of Carbon Nanotubes to Energy Storage Devices

### 탄소나노튜브의 에너지 저장장치에의 응용

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We have investigated key factors for the applications of singlewalled carbon nanotubes (SWNTs) to various energy storage systems, such as hydrogen storage, Li-ion secondary, and supercapacitor.

In electrochemical hydrogen storage, the maximum discharging storage capacity of 450 mAh/g (1.63 H-wt%) was obtained at a cutoff voltage of 0.8 V by controlling the amount of transition metals during synthesis and post-annealing process.

For Li-ion battery using SWNT electrodes, we emphasize that the discharge efficiency and recyclability are very excellent, which is very important to apply practical device. SWNT electrodes showed about 560 mAh/g (Li<sub>1.56</sub>C<sub>6</sub>) of the maximum reversible specific capacity, significantly higher than the ideal value of LiC<sub>6</sub> (372 mAh/g) for graphite. It is suggested that Li-reversible intercalation sites are the interstitial bundles of SWNTs.

In case of supercapacitor using SWNT electrodes, the SWNT electrodes annealed at 1000 °C for 30 min have a maximum specific capacitance of 180 F/g. Singlewalled carbon nanotube (SWNT) and Polypyrrole (Ppy) hybrid electrode was fabricated to more improve the specific capacitance of the supercapacitor. We obtained a maximum specific capacitance of 265 F/g from the SWNT-Ppy hybrid electrode containing 15 wt% of conducting agent.