Effects of Functionalities on Selfdischarge Process: A Step-Forward Study on Energy Retention of Single-Walled Carbon Nanotube Based Supercapacitors

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Self-discharge study of supercapacitors is critical in prolonging their energy retention, which in order would benefit their application in energy storage. Our previous work on self-discharge mechanisms with supercapacitors built with single-walled carbon nanotubes (SWNT) suggests that surface chemistry would affect self-discharge by interfering with the electro-static interaction between electrolytic ions and SWNT surface. Herein, further research has been designed to confirm this hypothesis as well as study the effects of the functionalities on self-discharge tuning. The experiment results give well correlation between self-discharge performance and the functionalities attached to electrode surface, demonstrating the validation of our hypothesis on the self-discharge mechanisms. Furthermore, the time of self-discharge process to reach 1 V is extended by ~4 times with functionalities decreasing ~10%. Tuning the self-discharge is proved to be practicable for the supercapacitors with SWNTs as trimming the surface chemistry of the electrodes.