Electric Double-layer Capacitance and Pseudocapacitance Contributions to the Oxidative Modification of Helical Carbon Nanofibers

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Surface functionalization with oxygen-containing functional groups of helical carbon nanofibres (HCNFs) is a simple and effective method to increase the capacitive performance of the HCNFs. However, the contribution of the electric double-layer capacitance (EDLC) and pseudocapacitance (PC) to the overall behaviour of supercapacitors has not yet been explored. A HNO₃ treatment and the modified Hummers method were used to increase the oxygen-containing functional groups and specific surface area of the HCNFs. The increase in the specific surface area enhanced the EDLC, while the oxygen-containing functional groups led to PC. As a result of the modified Hummers method, the HCNFs with a specific surface area of 78.82 m²/g and containing 28.03 at.% oxygen had a specific capacitance of 143.6 F/g at 1 A/g, which is much higher than that of the pristine HCNFs (10.7 F/g). In addition, the contribution of the EDLC and PC were evaluated and are discussed.

Keywords: Helical carbon nanofibers, pseudocapacitance, electric double-layer capacitance, oxidative modification

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