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Carbon fibers surface-grown with helical carbon nanotubes and polyaniline for high-performance electrode materials and flexible supercapacitors

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Abstract: Carbon fiber-based flexible supercapacitors have attracted wide attention due to their excellent properties. In this paper, a novel high performance flexible supercapacitor is reported. The carbon fibers surface-grown with helical carbon nanotubes (CF-HCNTs) are prepared using chemical vapor deposition and then combined with PANI by in-situ polymerization to form a 3D porous structure. The carbon fibers surface-grown with helical carbon nanotubes and polyaniline (CF-HCNTs-PANI)flexible supercapacitor electrodes exhibit a high capacitance of 660F/g at a current density of 1 A/g with good cycling stability (90.4% capacitance retention after 1000 charge/discharge cycles) and low interfacial charge-transfer resistance of 0.5Ω. These excellent electrochemical performances are attributed to faradic pseudocapacity, large surface area, 3D porous structure of the CF-HCNTs-PANI electrodes and unique multi-scale fibrous materials. Furthermore, the all-solid-state CF-HCNTs-PANI flexible supercapacitor shows a good specific capacitance of