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Two-Steps Electrode Position of Manganese Oxides Nanoflakes on Carbon Fibers for Flexible and High Performance Wearable Super Capacitors

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Internet of things and big data acquisition demand portable and compatible energy storage devices for retrieving and processing information. Supercapacitors being high power, high rate capable and long cyclic life energy devices are promising candidates among its commercial counterparts. Aforementioned, energy requests can be addressed by integrating fiber shaped flexible supercapacitors on to physical substrates and textiles. Therefore, current collectors must be flexible and should be configurable into complex devices such as pacemakers, artificial skins, foldable displays, wireless sensors and smart cards. In current study, we report the two-steps electro deposition of stoichiometric MnO_2nanoflakes on carbon fiber and their H-inserted MnO_{2-x}phases for high performance flexible super capacitors. The two-steps deposition of MnO_2 enable to achieve uniform and crack free nano flake-structured films. As deposited electrodes showed promising capacitive performance in neutral electrolyte (0.5M Na_2SO_4) at slightly basic conditions with specific capacitance as high as 575 F/g. KOH-activation of the carbon fibers shows an improvement in capacitance up to 600 F/g at 1 A/g current density. We have also worked on a reliable and low cost approach to enhance the capacitive performance of these electrodeposited carbon fibers. The hydrogenation of these MnO_2 electrodeposited electrodes exhibited remarkable improvement in capacitance up to 835 F/g. The superior capacitive performance can be attributed to the hierarchal deposition of two uniform, continuous and highly porous layers of stochiometric and H-inserted MnO_{2-x}. Surface oxygen vacancies contribute to improve conductivity and kinetics of the surface redox reactions.