One-step electrodeposition of poly(indole-7-carboxylic acid) nanowires and their high capacitance properties

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One-step electropolymerization of indole-7-carboxylic-acid (ICA) on glassy carbon electrode in acetonitrile led to the formation of electroactive poly(indole-7-carboxylic acid) (PICA) nanowires with conductivity of $5 \times 10^{-2}$ S cm$^{-1}$. The structure of PICA was characterized by UV-vis, FTIR and $^1$HNMR. Scanning electron microscopy (SEM) result showed that as-obtained PICA was clear nanowire with a diameter of 30-50 nm (Figure 1), the formation of nanowire was proposed to come from the hydrogen bonding interaction between –COOH and –NH. The electrochemical capacitance properties of the PICA nanowires were investigated with cyclic voltammetry, galvanostatic charge–discharge and electrochemical impedance spectroscrope techniques. A remarkable specific capacitance of 387 F g$^{-1}$ is obtained at a scan rate of 5 mV s$^{-1}$ in 1 M H$_2$SO$_4$ solution. PICA nanowires presented excellent long cycle life with 91% specific capacitance retention after 1000 charge–discharge processes (Figure 2). The above results implied that the PICA nanowires will be a kind of promising electrode material for supercapacitors.