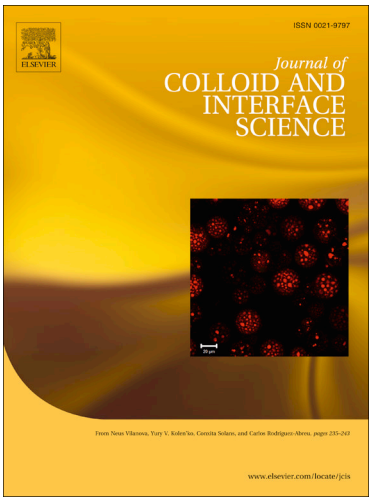

In-situ grown manganese silicate from biomass-derived heteroatom-doped porous carbon for supercapacitors with high performance

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In-situ grown manganese silicate from biomass-derived heteroatom-doped porous carbon for supercapacitors with high performance

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Abstract

Supercapacitor performance is reported for manganese silicate hybridized carbon materials (MnSi-C) that is derived from natural bamboo leaves. The in-situ generated manganese silicate is in good distribution by a simple hydrothermal treatment without the addition of another controlling agent. We also study the performance of MnSi-C as a single electrode and a cathode for fabrication of asymmetric supercapacitor device with a $Ni(OH)_2$ anode. Remarkably, the single electrode MnSi-C-3 delivered a capacity of 162.2 F g^{-1} at a current density of 0.5 A g^{-1}. The cyclic performance of single electrode MnSi-C-3 maintains high capacitance retention of 85% after 10000 cycles of charge-discharge. By assembled MnSi-C-3 with $Ni(OH)_2$, the asymmetric supercapacitor device shows a capacity of 438.5 mF cm^{-2} at a scan rate of 4 mA cm^{-2}. The device exhibits an optimal electrochemical performance with an energy density of 3 mWh cm^{-3} (24.6 Wh kg^{-1}) and power density of 130.4 mW cm^{-3} (604.8 W kg^{-1}). A reasonable mechanism of in-situ generated manganese silicate on the surface of carbon is proposed based on the experimental data and existed theories. This MnSi-C nanocomposite proves to be a promising electrode material for high energy supercapacitor.

Keywords: Bamboo leaves; $MnSiO_x$–C material; in-situ generated; supercapacitor; formation mechanism