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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)<sub>2</sub> anode. Remarkably, the single electrode MnSi-C-3 delivered a capacity of 162.2 F g<sup>-1</sup> at a current density of 0.5 A g<sup>-1</sup>. 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)<sub>2</sub>, the asymmetric supercapacitor device shows a capacity of 438.5 mF cm<sup>-2</sup> at a scan rate of 4 mA cm<sup>-2</sup>. The device exhibits an optimal electrochemical performance with an energy density of 3 mWh cm<sup>-3</sup> (24.6 Wh kg<sup>-1</sup>) and power density of 130.4 mW cm<sup>-3</sup> (604.8 W kg<sup>-1</sup>). 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<sub>x</sub>-C material; in-situ generated; supercapacitor; formation mechanism

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