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# *Novel Nanocomposite of $MnFe_2O_4$ and Nitrogen-doped Carbon from Polyaniline Carbonization as Electrode material for Symmetric Ultra-stable Supercapacitor*

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## Abstract

In this work, direct carbonization of polyaniline manganese ferrite (Mn-PANI) nanocomposite was employed to prepare a novel N-doped carbon material decorated with manganese ferrite (Mn-CPANI) and implemented as an ultra-stable symmetric supercapacitor electrode material. The surface morphology of as-prepared samples is investigated with field-emission scanning electron microscopy (FE-SEM) and transmission electron microscopy (TEM). Also, uniform distribution of manganese ferrite ($MnFe_2O_4$) on PANI surface and the N-doped carbon material is confirmed through EDX analysis. Carbonized nanocomposite contains about 8 wt. % of nitrogen. The obtained Mn-CPANI nanocomposite shows a high specific capacitance of 329 F $g^{-1}$ and exhibits excellent capacitance retention of 83.2% from 1 to 10 A $g^{-1}$, which is more stable compared to Mn-PANI nanocomposite. Moreover, the symmetric Mn-CPANI supercapacitor cell possesses a specific capacitance of about 246 F $g^{-1}$ (at 1 A $g^{-1}$) and an excellent stable cyclability (only 3% of specific capacitance decreases after 10000 cycles). The excellent enhanced electrochemical performance of Mn-CPANI nanocomposite could be originated from the combination and synergism of N-doped carbon material as an electrical double-layer capacitor with pseudocapacitive $MnFe_2O_4$. As a result, a novel electrode material is developed for high-performance ultra-stable energy storage devices.

***Keywords:*** *Carbonization, Manganese ferrite, Polyaniline, Nitrogen–doped carbon, Supercapacitor, Symmetric system*