Electrospinning Preparation of Fe₃O₄/Porous Carbon Nanofibres for use as Supercapacitor Electrode Materials

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doi: 10.20964/2020.05.72

Received: 30 January 2020 / Accepted: 2 March 2020 / Published: 10 April 2020

A Fe₃O₄/porous carbon nanofibre (Fe₃O₄/CNF) was prepared by carbonization of electrospun polyacrylonitrile (PAN)/polymethylmethacrylate (PMMA) composite nanofibres and used as electrode materials for supercapacitors. The introduction of PMMA as a pore-forming agent in PAN results in an optimum pore distribution and a more suitable specific surface area for Fe₃O₄/CNF; the improved pores and surface area contribute to the diffusion of the electrolyte from the surface to the inside of the electrode material. Electrochemical measurements of the Fe₃O₄/CNF in three- and two-electrode systems reveal a maximum specific capacitance of 540 F g⁻¹ in the three-electrode system and a capacitance retention of 76.3 % after 5000 continuous cycles in the two-electrode system. Due to the synergistic effect of redox pseudocapacitance behaviour and bilayer capacitance, the excellent electrochemical performance of the Fe₃O₄/CNF electrode highlights the importance of adding PMMA into composite materials.

Keywords: iron oxide; carbon nanofibers; pore structure; liquefied carbon; supercapacitors

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