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Mass-loading effect of graphene foam (GF) on the electrochemical performance of nickel phosphate as an electrode for supercapacitor application

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This work presents the effect of different contents of graphene foam (GF) on the electrochemical capacitance of nickel phosphate Ni₃(PO₄)₂ nanorods as an electrode material for supercapacitor applications. Ni₃(PO₄)₂ nanorods were synthesized via a hydrothermal method followed by different mass loading of graphene (30, 60, 90 and 120 mg, denoted as Ni₃(PO₄)₂/30 mg GF, Ni₃(PO₄)₂/60 mg GF, Ni₃(PO₄)₂/90 mg GF and Ni₃(PO₄)₂/120 mg GF, respectively. The electrochemical behavior of Ni₃(PO₄)₂ and Ni₃(PO₄)₂/GF nanorods composites were analyzed in a three-electrode cell using cyclic voltammetry (CV), galvanostatic charge–discharge (GCD) and electrochemical impedance spectroscopy (EIS) in a 6 M KOH electrolyte. The electrochemical tests showed that the specific capacitance increased with increasing the GF content up to 90 mg then decreased. The Ni₃(PO₄)₂/90 mg GF exhibited the highest specific capacitance of 606 F g⁻¹ (using CV curve) and 462 F g⁻¹ (using CD curve) at 5 mV s⁻¹ scan rate and 0.5 A g⁻¹ current density respectively. The high specific capacitance is attributed to good crystallinity and synergetic interaction of the GF and Ni₃(PO₄)₂ nanorods.

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Level for award
 (Hons, MSc,
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PhD

Main supervisor (name and email)
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Yes

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