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Conducting α-Fe_2O_3 Nanorod/Polyaniline/CNT Gel Framework for High Performance Anodes towards Supercapacitors

Zhaokun Yang [ab], Aidong Qiu [b], Jun Ma*[b] and Mingqing Chen*[a]

[a] *Key Laboratory of Synthetic and Biological Colloids, Ministry of Education, School of Chemical and Material Engineering, Jiangnan University, Wuxi 214122, P. R. China. E-Mail: mqchen@jiangnan.edu.cn*

[b] *School of Engineering, University of South Australia, Mawson Lakes, SA 5095, Australia. E-mail: Jun.Ma@unisa.edu.au*

ABSTRACT: Thick-electrode design toward high energy density per device is of particular importance for supercapacitors to store large amounts of energy, but this remains a seemingly insurmountable challenge due to sluggish electron transport. The challenge is addressed herein by developing an electrically and ionically conducting framework which consists of α-Fe_2O_3 nanorods, multi-walled carbon nanotubes (CNTs) and polyaniline (PANi) hydrogel. The interconnecting composite framework is formed by *in situ* polymerizing aniline on the surface of α-Fe_2O_3 nanorods and CNTs; the nanorods are found to well disperse in the matrix. The framework can provide low-resistance, continuous transport pathways for both electrons and electrolyte ions in the entire electrode system, maximizing the energy use of the nanorods. An anode of ~100 μm in thickness is fabricated using the composite framework, corresponding to a mass loading of 9.3 mg cm^{-2}. It delivers high area capacitance of 2434.7 mF cm^{-2} and cycling capacitance retention of 96.3 % after 10,000 cycles. This work would shed light