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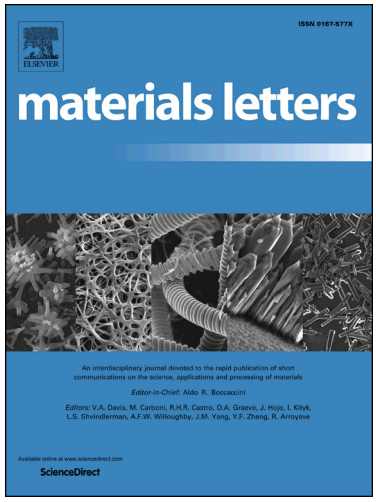

$ZnWO_4$ nanoflakes decorated $NiCo_2O_4$ nanoneedle arrays grown on carbon cloth as supercapacitor electrodes

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$ZnWO_4$ nanoflakes decorated $NiCo_2O_4$ nanoneedle arrays grown on carbon cloth as supercapacitor electrodes

Song Han[a], Liyang Lin[a,*], Kaihua Zhang[a], Longjing Luo[c], Xianghe Peng[a], Ning Hu[a,b,*]

[a] College of Aerospace Engineering, Chongqing University, Chongqing 400044, China

[b]The State Key Laboratory of Mechanical Transmissions, Chongqing University, Chongqing

[c] College of Materials Science and Engineering, Chongqing University, Chongqing 400030, China

ABSTRACT: We have successfully realized a high-capacity, good-rate-capability, and long-life supercapacitor electrode by developing the hierarchical 3D $NiCo_2O_4$ nanoneedle arrays (NNAs)@$ZnWO_4$ nanoflakes (NFs) core-shell structures on carbon cloth (CC) for the first time. The free-standing CC@$NiCo_2O_4$@$ZnWO_4$ electrode gives rise to a high specific capacity of 296.5 Cg^{-1} at a current density of 0.5 Ag^{-1} and 269.0 Cg^{-1} even at 10 Ag^{-1}, and retains ~90.1% of the capacity even after 5000 cycles of charge and discharge. Compared with CC@$NiCo_2O_4$ electrode, the remarkable electrochemical behaviors demonstrate that $ZnWO_4$ NFs decorated $NiCo_2O_4$ NNAs on CC as a new type of electrode is highly desirable for application as high-performance electrochemical supercapacitors.

Keywords: Carbon cloth; Nanoneedle arrays; Functional; Supercapacitors; Energy storage and conversion

1. Introduction

Recently, flexible energy-storage devices including supercapacitors and batteries have attracted significant attention for meeting the requirements of miniature intelligent electronic device, novel wearable electronic equipment and modern portable electronic instrument (for example, smart clothes, bendable mobile electronic products, and folding charger) [1-3]. Carbon cloth (CC) as a superior current collector,

* Corresponding authors.
E-mail addresses: jack_linliyang@cqu.edu.cn (L.Y. Lin), ninghu@cqu.edu.cn (N. Hu).