

Accepted Manuscript

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PII: S1385-8947(16)31359-6
DOI: <http://dx.doi.org/10.1016/j.cej.2016.09.115>
Reference: CEJ 15825

To appear in: *Chemical Engineering Journal*

Received Date: 28 July 2016
Revised Date: 22 September 2016
Accepted Date: 23 September 2016

Please cite this article as: C. Yang, L. Zhang, N. Hu, Z. Yang, Y. Su, S. Xu, M. Li, L. Yao, M. Hong, Y. Zhang, Rational design of sandwiched polyaniline nanotube/layered graphene/polyaniline nanotube papers for high-volumetric supercapacitors, *Chemical Engineering Journal* (2016), doi: <http://dx.doi.org/10.1016/j.cej.2016.09.115>

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Rational design of sandwiched polyaniline nanotube/layered**graphene/polyaniline nanotube papers for high-volumetric supercapacitors**

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Abstract

The adjustment and optimization of graphene-based electrode structures are crucial to achieve both high volumetric and gravimetric capacitances for portable energy storage devices. Structures of reduced graphene oxide (RGO)-polyaniline (PANI) nanotube hybrid electrodes were facilely regulated and rationally designed by *in-situ* MnO₂ nanowire-templated polymerization. Typically, two different architectures of RGO-PANI composites were obtained by controlling the content of MnO₂ nanowires in graphene papers. The assembled symmetric device based on the porous RGO-PANI nanotube papers (0.18 mg cm⁻², 20.0 μm), showed a high gravimetric specific capacitance of 956 F g⁻¹ (against the mass of single electrode) at 1 A g⁻¹ with excellent rate capability of 74.3% from 1 A g⁻¹ to 10 A g⁻¹. In addition, another symmetric device based on the sandwiched polyaniline nanotube/layered graphene/polyaniline nanotube papers (0.80 mg cm⁻², 4.02 μm), provided an ultrahigh volumetric capacitance (722 F cm⁻³ at 2 A cm⁻³) and a decent gravimetric capacitance

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