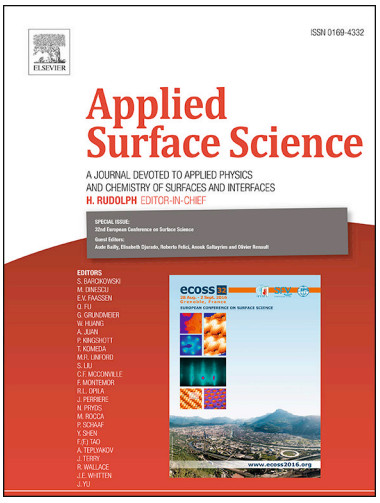
Accepted Manuscript



Full Length Article

Amphiphilic Ligand Exchange Reaction-Induced Supercapacitor Electrodes with High Volumetric and Scalable Areal Capacitances

Donghyeon Nam, Yeongbeom Heo, Sanghyuk Cheong, Yongmin Ko, Jinhan Cho

PII: S0169-4332(18)30166-1
DOI: https://doi.org/10.1016/j.apsusc.2018.01.153
Reference: APSUSC 38292

To appear in: *Applied Surface Science*

Received Date: 28 August 2017
Revised Date: 26 December 2017
Accepted Date: 18 January 2018

Please cite this article as: D. Nam, Y. Heo, S. Cheong, Y. Ko, J. Cho, Amphiphilic Ligand Exchange Reaction-Induced Supercapacitor Electrodes with High Volumetric and Scalable Areal Capacitances, *Applied Surface Science* (2018), doi: https://doi.org/10.1016/j.apsusc.2018.01.153

Amphiphilic Ligand Exchange Reaction-Induced Supercapacitor Electrodes with High Volumetric and Scalable Areal Capacitances

Donghyeon Nam, Yeongbeom Heo, Sanghyuk Cheong, Yongmin Ko*, and Jinhan Cho*

Department of Chemical & Biological Engineering, Korea University, 145 Anam-ro, Seongbuk-gu, Seoul, 02841, Republic of Korea.

*Corresponding authors.

E-mail addresses: radiofeel@korea.ac.kr (Y. Ko), and jinhan71@korea.ac.kr (J. Cho)

ABSTRACT

We introduce high-performance supercapacitor electrodes with ternary components prepared from consecutive amphiphilic ligand-exchange-based layer-by-layer (LbL) assembly among amine-functionalized multi-walled carbon nanotubes (NH_2-MWCNTs) in alcohol, oleic acid-stabilized Fe_3O_4 nanoparticles (OA-Fe_3O_4 NPs) in toluene, and semiconducting polymers (PEDOT:PSS) in water. The periodic insertion of semiconducting polymers within the (OA-Fe_3O_4 NP/NH_2-MWCNT)$_n$ multilayer-coated indium tin oxide (ITO) electrode enhanced the volumetric and areal capacitances up to 408 ± 4 F cm^{-3} and 8.79 ± 0.06 mF cm^{-2} at 5 mV s^{-1}, respectively, allowing excellent cycling stability (98.8 % of the initial capacitance after 5000 cycles) and good rate capability. These values were higher than those of the OA-Fe_3O_4 NP/NH_2-MWCNT multilayered electrode without semiconducting polymer linkers (volumetric capacitance ~ 241 ± 4 F cm^{-3} and areal capacitance ~ 1.95 ± 0.03 mF cm^{-2}) at the same scan rate. Furthermore, when the asymmetric supercapacitor cells (ASCs) were prepared using OA-Fe_3O_4 NP- and OA-MnO NP-based ternary component electrodes, they displayed high volumetric energy (0.36 mW h cm^{-3}) and power densities (820 mW cm^{-3}).