

## Author's Accepted Manuscript

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PII: S2211-2855(17)30629-8  
DOI: <https://doi.org/10.1016/j.nanoen.2017.10.025>  
Reference: NANOEN2259

To appear in: *Nano Energy*

Received date: 8 September 2017  
Revised date: 6 October 2017  
Accepted date: 9 October 2017

Cite this article as: Chun Wang, Faxing Wang, Zaichun Liu, Yujuan Zhao, Yong Liu, Qin Yue, Hongwei Zhu, Yonghui Deng, Yuping Wu and Dongyuan Zhao, N-doped Carbon Hollow Microspheres for Metal-free Quasi-solid-state Full Sodium-ion Capacitors, *Nano Energy*, <https://doi.org/10.1016/j.nanoen.2017.10.025>

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# N-doped Carbon Hollow Microspheres for Metal-free Quasi-solid-state Full Sodium-ion Capacitors

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## Abstract

N-doped carbon hollow microspheres have been synthesized by a facile interfacial sol-gel coating process using resorcinol/formaldehyde as the carbon precursor and ethylenediamine (EDA) as both the base catalyst and nitrogen precursor. They possessed uniform size of ~ 120 nm in diameter with porous shells as thin as ~ 10 nm. The BET specific surface area and pore volume were measured to be 267 m<sup>2</sup>·g<sup>-1</sup> and 1.2 cm<sup>3</sup>·g<sup>-1</sup>, respectively. The nitrogen doping of 8.23 wt % in carbon matrix could be achieved without sacrificing the hollow spherical morphology. Density functional theory (DFT) calculation results clearly reveal that N-doping could significantly change the interaction sites and enhance the adsorption of PF<sub>6</sub><sup>-</sup> ions towards carbon framework. Quasi-solid-state full sodium-ion capacitors employing the nanoporous

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