Facile Synthesis of Polypyrrole Nanotubes and Their Supercapacitive Application

Yan Yan^{†1,2}, Huiqin Li^{†1,2}, Yuan Zhang^{1,2}, Jinqing Kan^{1,2}, Tengfei Jiang^{1,2},
Huan Pang^{1,2,*}, Zhengxi Zhu^{1,2,*} and Huaiguo Xue^{1,2,*}

¹ School of Chemistry and Chemical Engineering, Yangzhou University, Yangzhou, 225002, Jiangsu, P. R. China.

² Institute for Innovative Materials and Energy, Yangzhou University, Yangzhou, 225002, Jiangsu, P. R. China.

† These authors contributed equally to this paper.

*E-mail: huanpangchem@hotmail.com; zhuzx@yzu.edu.cn; chhgxue@yzu.edu.cn;

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Polypyrrole nanotubes (PPy-NTs) with uniform diameters were synthesized by the situ chemical oxidation polymerization with pyrrole, methyl orange (MO) and FeCl₃ as material, dopant and oxidant, respectively. The products were characterized by TEM, SEM, IR, EDS and TGA. polymerization parameters, such as the concentrations of reactants, temperature, and the types of solvents on the diameters of the nanotubes have been investigated. The results showed that the diameters of the PPy-NTs can be controlled in a relatively stable value (~100 nm) by adjusting the concentrations of reactants, temperature, types of solvents. The diameter of PPy-NTs affect the capacitive behavior of active material. The maximum specific capacitance is 960 F g⁻¹ at 0.5 A g⁻¹ with the concentrations of FeCl₃, MO and Py are 250 mM, 5.0 mM, and 50.0 mM, respectively. It also shows excellent cycle performance, after 10000 charge and discharge cycle the specific capacitance was still maintained as the original 97.1%. This study basically provides a new method for controlling the composition of PPy-NTs with uniform diameter, which facilitates the development of electrochemically active materials for supercapacitors.

Keywords: polypyrrole, nanotubes; supercapacitor

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