Nickel Hydroxide Nanoflakes Grown on Carbonized Melamine Foam via Chemical Bath Deposition for Supercapacitor Electrodes

Seongwoo Jeong^{1†}, Jemoon Yun², Nanasaheb M. Shinde², Kyung Su Kim¹, Kwang Ho Kim^{1,2,*}

¹ School of Materials Science and Engineering, Pusan National University, San 30 Jangjeon-dong, Geumjeong-gu, Busan 609-735, Republic of Korea

² Global Frontier R&D Center for Hybrid Interface Materials, Pusan National University, San 30 Jangjeon-dong, Geumjeong-gu, Busan 609-735, Republic of Korea

*E-mail: kwhokim@pusan.ac.kr

doi: 10.20964/2020.02.29

Received: 1 October 2019 / Accepted: 27 November 2019 / Published: 31 December 2019

Ni(OH)₂ nanoflakes were deposited on a carbonized melamine foam (CMF) substrate (Ni(OH)₂ @CMF) via chemical bath deposition at room temperature. This was achieved by using three different Ni(OH)₂ precursor solution concentrations. Ni(OH)₂ @CMF-0.05 was obtained using a 0.05 M Ni(OH)₂ solution and exhibited a high specific capacitance of 1066 F g⁻¹ at a specific current of 1 A g⁻¹; further, this material retained a specific capacitance of 698 F g⁻¹ at a specific current of 5 A g⁻¹. At a scan rate of 5 mV s⁻¹, the specific capacitance of Ni(OH)₂ @CMF-0.05 was 965 F g⁻¹. This excellent electrochemical performance is ascribed to the large amount of functional groups in CMF, which allowed for its facile reaction with Ni(OH)₂ during the synthesis of Ni(OH)₂ @CMF as well as with the hydroxide ions in the electrolyte during charge/discharge cycles. The monolithic device, which was achieved owing to the three-dimensional structure of CMF, delivered a high energy density of 27.5 Wh kg⁻¹ at a power density of 140 W kg⁻¹ and a high power density of 7.5 kW kg⁻¹ at an energy density of 6.6 Wh kg⁻¹. The device retained 100% of its energy density after 8000 charge/discharge cycles. This work suggests a potential approach to utilize melamine foam as a substrate for the low-cost growth of metal hydroxide nanostructures that can be used as electrode supercapacitors.

Keywords: Ni(OH)₂, N-doped carbon, melamine foam, CBD, supercapacitor

[FULL TEXT](#)

© 2020 The Authors. Published by ESG (www.electrochemsci.org). This article is an open access article distributed under the terms and conditions of the Creative Commons Attribution license (<http://creativecommons.org/licenses/by/4.0/>).