Protein Powder Derived Porous Carbon Materials as Supercapacitor Electrodes

Ben Niu¹, Mengying Yuan¹, Feng Jiang¹, Mei Li^{1,2,3,*}

¹ School of Materials Science and Engineering, Qilu University of Technology (Shandong Academy of Sciences), Jinan 250353, P.R. China

² Shandong Provincial Key Laboratory of Processing and Testing Technology of Glass and Functional Ceramics, Jinan 250353, P.R. China.

³ Key Laboratory of Amorphous and Polycrystalline Materials, Qilu University of Technology (Shandong Academy of Sciences), Jinan 250353, P.R. China.

*E-mail: lim@qlu.edu.cn

doi: 10.20964/2019.04.33

Received: 9 December 2018 / Accepted: 28 January 2019 / Published: 10 March 2019

Protein-based microporous carbon (PMC) with high nitrogen, sulfur content and the specific surface area was obtained from commercial protein powder (PP) by KOH activation. Many interconnected micropores and mesopores were formed in the carbonization process, the specific surface area of the PMC was up to 1117 m² g⁻¹. The nitrogen content is 15.29 at.% , sulfur percent is 0.71 at.% in the as-prepared PMC. Both high specific area and heteroatom content bring the ideal capacitance characteristics when PMC was fabricated as supercapacitor electrodes. The different carbonization temperature and activation ratio of PP to KOH have been discussed to get the best electrochemical performances. The specific capacitance of PMC600-1:2 was up to 336 F g⁻¹ at a current density of 1 A g⁻¹, much higher than that of commercial electrodes. The capacitance retention is 173 F g⁻¹ at 10 A g⁻¹, indicating that the PMC owns good rate capability. At the same time, the cycling stability of the sample is 83 % after 10000 cycles at 10 A g⁻¹. Furthermore, an as-fabricated PMC-based symmetric supercapacitor device shows a high energy density of 27 W h kg⁻¹ at a power density of 900 W kg⁻¹.

Keywords: Microporous carbon, Nitrogen doping, Electrochemical performance, Supercapacitors

[FULL TEXT](#)

© 2019 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/>).