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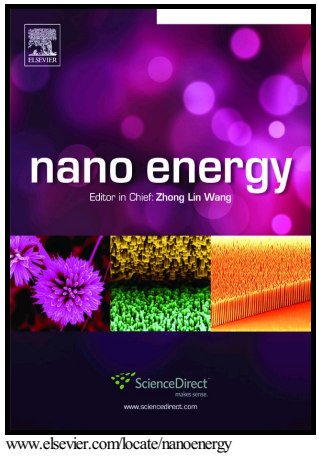

www.elsevier.com/locate/nanoenergy

PII: S2211-2855(17)30764-4
DOI: https://doi.org/10.1016/j.nanoen.2017.11.070
Reference: NANOEN2371

To appear in: *Nano Energy*

Received date: 12 October 2017
Revised date: 22 November 2017
Accepted date: 30 November 2017

Cite this article as: Bin Bian, Dai Shi, Xiaobing Cai, Mingjun Hu, Qiuquan Guo, Chuhong Zhang, Qi Wang, Andy Xueliang Sun and Jun Yang, 3D Printed Porous Carbon Anode for Enhanced Power Generation in Microbial Fuel Cell, *Nano Energy,* https://doi.org/10.1016/j.nanoen.2017.11.070

3D Printed Porous Carbon Anode for Enhanced Power Generation in Microbial Fuel Cell

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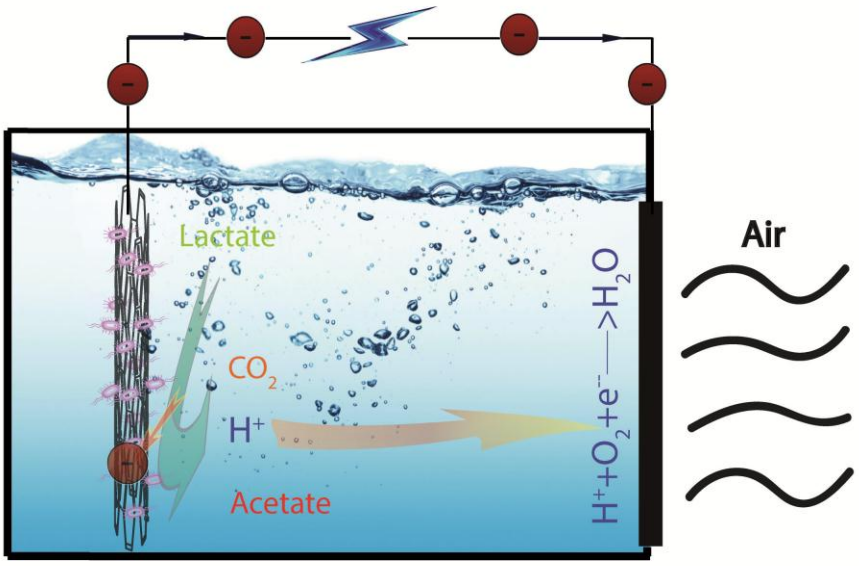
Abstract

3D porous carbon structures, fabricated via 3D printing technique, were first utilized as the anode materials for microbial fuel cells (MFCs). The intrinsic biocompatibility of 3D printed carbon anodes, together with the open porous structures, greatly enhanced the metabolic activities of microorganisms. The secondary 3D roughness generated from carbon formation functioned as an ideal support for microbial growth, which further increased the surface area of anodes as well. All these factors together determined the exclusive electrochemical performances of MFCs for enhanced power generation and scaling up application. Through carefully tuning the carbonization processes, a multiscale 3D porous carbon structure was achieved for bacterial growth and mass transfer, leading to the highest maximum output voltage, open circuit potential (OCP) and power density for a 300 μm porosity (453.4±6.5mV, 1256±69.9 mV and 233.5±11.6 mWm^{-2}, respectively). Such performance is superior to that of carbon cloth anode and carbon fiber brush anode under the same condition.

Graphical Abstract



Keywords: Microbial Fuel Cell, Shewanella MR-1, 3D printing, Porous Anode, Carbonization