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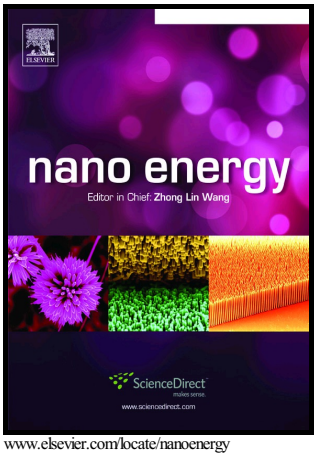

Highly Flexible and Scalable Photo-Rechargeable Power Unit Based on Symmetrical Nanotube Arrays

Fayin Zhang, Weifeng Li, Zijie Xu, Meidan Ye, Hongyao Xu, Wenxi Guo, Xiangyang Liu

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Fayin Zhang[ab], Weifeng Li[a], Zijie Xu[a], Meidan Ye[a], Hongyao Xu*[b], Wenxi Guo*[a], Xiangyang Liu*[ac]

[a] Research Institute for Soft Matter and Biomimetics, Fujian Provincial Key Laboratory for Soft Functional Materials Research, Department of Physics, Xiamen University, Xiamen 361005, China.

[b] The State Key Laboratory for Modication of Chemical Fibers and Polymer Materials, College of Materials Science and Engineering, Donghua University, Shanghai 201620,China.

[c] Department of Physics, Faculty of Science, National University of Singapore, Singapore, 117542, Singapore.

E-mail: wxguo@xmu.edu.cn; hongyaoxu@dhu.edu.cn; phyliuxy@nus.edu.sg.

Abstract

Here, we report an ultrathin flexible photo-charging power pack that integrates a perovskite solar cell (PSC) and electro-chemical supercapacitor (ESC) on bi-polar TiO_2 nanotube arrays (TNARs). Instead of two independent components, the integrated sandwich-type device allows the direct injection of the electrons generated by the PSCs into the ESCs through shared highly ordered bi-polar TNARs. Meanwhile, the holes separated from the perovskite layer divert into positive electrode of ESCs through an external circuit effectually. When the flexible photo-supercapacitor was illuminated with simulated solar light, the voltage of ESC was increased to 0.63 V within 30 s at the beginning of the charging period immediately. The optimized power pack exhibits a remarkable overall photoelectric conversion (4.9%) and storage efficiency up to 80%, with fast response and superior cycling capability. To meet applicable demands with a larger output voltage, these photo-supercapacitors are successfully woven into “bamboo slip” architecture, which can be folded, bended and allows tuning the open-circuit voltage (>2.4 V) by charging the number of photo-supercapacitor strips.