Bifunctional Flexible Electrochromic Supercapactiors Were Successfully Fabricated

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Researchers from the Harbin Institute of Technology and Southern University of Science and Technology have fabricated bifunctional flexible electrochromic energy-storage devices based on silver nanowire flexible transparent electrodes.

Publishing in the journal International Journal of Extreme Manufacturing, the team used silver nanowire flexible transparent electrodes as the current collector for bifunctional flexible electrochromic supercapacitor.

This bifunctional flexible device can exhibit the energy status through color changes, which can serve as an energy supplier for various wearable electronics, such as physiological sensors. The findings could have a widespread impact on the future development of smart windows for energy-efficient buildings.

In this work, silver nanowire network flexible electrode with excellent opto-electrical performance and mechanical flexibility was used as the collector. To improve the electrochromic stability of silver nanowire network, PEDOT:PSS was spin-coated. PEDOT: PSS can concurrently serve as the protective layer and electrochromic energy-storage layer. To further increase the device's energy densities, Co(OH)2 nanosheets were electrodeposited onto the silver nanowire network.

One of the lead researchers, Professor Yanhong Tian from Harbin Institute of Technology, commented, "Given the increasing demands of flexible visual energy suppliers and smart windows, it is burning to develop new materials, new technologies to meet these requirements."

The electrochromic energy-storage device is one of only few techniques that allows the presentation of energy status with the naked eyes. However, the fabrication of the flexible device is still hindered by the slow development of flexible transparent electrodes. First author He Zhang explained, “In our work, we use silver nanowires to replace conventional ITO material, and PEDOT: PSS can solve the electrochemical instability problem of silver nanowires.”

The symmetrical electrochromic supercapacitor assembled based on AgNWs/Co(OH)2/PEDOT:PSS in this work exhibited an areal capacitance of 0.8 mF/cm2 and coloration efficiency 269.8 cm2/C of. Furthermore, the obtained devices exhibited excellent stability against mechanical deformation. The areal capacitance remained stable during 1000 times cyclic bending with a 25-mm curvature radius. These results demonstrate the broad application potential of the flexible electrochromic supercapacitor for emerging portable and multifunctional electronics.

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