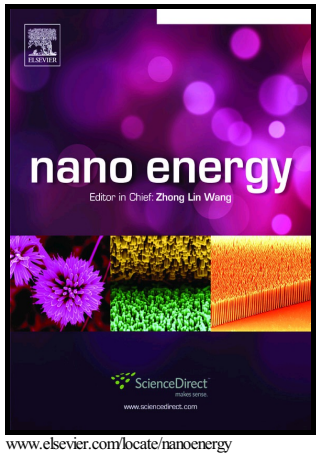

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Electrochemical approach to prepare integrated air electrodes for highly stretchable zinc-air battery array with tunable output voltage and current for wearable electronics

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Efficient stretchable and flexible energy devices are urgently required due to their promising application in wearable devices. Although flexible solid-state zinc-air batteries have been developed in previous studies, no stretchable Zn-air batteries with large stretchability (>20%) have been reported. We first present a planar rechargeable stretchable and flexible Zn-air battery array fabricated by layer-by-layer assembly of 2×2 electrode arrays, a polymer gel electrolyte, serpentine-shaped copper circuits, and a rubber substrate. Vertical Co_3O_4 nanosheets were fabricated by a binder-free and simple manner and were grown *in situ* on carbon cloth as an integrated cathode. The Zn-air battery array displayed stable electrochemical behaviors, with a large tensile strain of 100%. Furthermore, the battery array could be discharged stably at 1 V at a high current density of 2 mA cm^{-2} under high-frequency dynamic stretching (~100% strain per second) and bending conditions. In addition, by redesigning the arrangement of the electrode array, the stretchable Zn-air battery array could be configured to provide a wide range of output voltages, specifically from 1 to 4 V. The resulting Zn-air battery array was sewn onto cloth and applied to power a green light band