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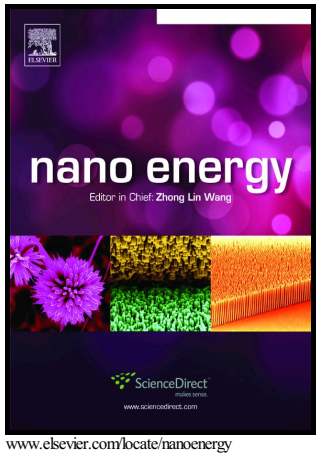

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MXene Electrochemical Microsupercapacitor Integrated with Triboelectric Nanogenerator as a Wearable Self-charging Power Unit

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Abstract

The development of miniaturized, wearable, and implantable electronics has increased the demand for small stand-alone power modules that have steady output and long life-time. Given the limited capacity of energy storage devices, one promising solution is to integrate energy harvesting and storage materials to efficiently convert ambient mechanical energy to electricity for direct use or to store the harvested energy by electrochemical means. Here, a highly compact self-charging power unit is proposed by integrating triboelectric nanogenerator with MXene-based microsupercapacitors in a wearable and flexible harvester-storage module. The device can utilize and store the random energy from human activities in a standby mode and provide power to electronics when active. As a result, our microsupercapacitor delivers a capacitance of 23 mF/cm^2 with 95% capacitance retention after 10,000 charge-discharge cycles, while the triboelectric nanogenerator exhibits a maximum output power of 7.8 $\mu W/cm^2$. Given the simplicity and integrated nature, our device can be integrated with a variety of electronic devices and sensors.

[1] *Contributed equally to the work*