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Micro-Nano Electrochemical Energy Storage Materials and Devices

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ABSTRACT

With the rapid development of electric vehicles, portable electronics, and wearable devices, advanced electrochemical energy-storage materials and devices have attracted extensive research interest. Emerging manufacturing technologies, particularly 3D printing, provide new opportunities for constructing energy-storage systems with complex architectures, customizable geometries, and integrated functionalities. Against this background, this work focuses on the advanced manufacturing of next-generation energy-storage materials and devices, with particular emphasis on 3D/4D-printed wearable batteries and capacitors, as well as the monolithic integration of flexible energy systems. A series of broadly applicable 3D-printing strategies have been developed for the fabrication of high-performance electrochemical energy-storage materials and devices, enabling excellent electrochemical performance while addressing key limitations associated with scalable and generalized 3D printing of advanced batteries. In addition, flexible system-level energy platforms have been constructed to explore emerging device configurations and application scenarios for energy storage. The intrinsic electrochemical mechanisms governing these systems have also been systematically investigated, providing fundamental insights and practical guidance for the design and manufacture of future integrated, flexible, and high-performance energy-storage technologies.

KEYWORDS

3D printing; electrochemical energy storage; wearable energy devices; flexible integrated energy systems

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