

# Charging energy storage devices

Could a flexible self-charging system be a solution for energy storage?

Considering these factors, a flexible self-charging system that can harvest energy from the ambient environment and simultaneously charge energy-storage devices without needing an external electrical power source would be a promising solution.

What is an energy storage system?

An energy storage system (ESS) for electricity generation uses electricity (or some other energy source, such as solar-thermal energy) to charge an energy storage system or device, which is discharged to supply (generate) electricity when needed at desired levels and quality. ESSs provide a variety of services to support electric power grids.

What is a hybrid-charging system based on TENGs and solar cells?

For hybrid-charging systems based on TENGs and solar cells, fibre-shaped devices that simultaneously harvest light energy and mechanical energy are the most favourable [119,120,121,122]. The devices can be hybridized in parallel on a single fibre or woven together onto a textile.

What is power management for a TENG-based self-charging system?

Generally, the power management for a TENG-based self-charging system involves one or some of these processes through device designs and circuits: converting AC to DC, boosting charge, stepping down voltage and stabilizing voltage (Fig. 4c).

What are flexible self-charging power sources?

Flexible self-charging power sources integrate energy harvesters, power management electronics and energy-storage units on the same platform; they harvest energy from the ambient environment and simultaneously store the generated electricity for consumption. Thus, they enable self-powered, sustainable and maintenance-free soft electronics.

What is a hybrid energy storage device?

Hybrid devices, which take advantage of both battery-type materials and capacitive materials, aim to simultaneously produce high energy density and high power density, striking a balance between both [60,61,62,63,64]. Developing flexible or even stretchable energy-storage devices is particularly important for wearable devices (Fig. 2e).

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