

# New materials with high energy storage density

What is the energy-storage density of PL/20 nm PN heterostructure?

A large recoverable energy-storage density of  $43.5 \text{ J/cm}^3$  and a high energy-storage efficiency of 84.1%, were obtained in the 180 nm thick PL/20 nm PN heterostructure under moderate electric field of  $2450 \text{ kV/cm}$  (i.e., 49 V).

Are pure carbon materials suitable for high energy density supercapacitor applications?

Overall, pure carbon materials are facing the specific capacitance limitation ( $\sim 300 \text{ F g}^{-1}$ ) practically, which are insufficient for high energy density supercapacitor application unless the voltage window can be largely expanded.

What are high entropy battery materials?

High-entropy battery materials (HEBMs) have emerged as a promising frontier in energy storage and conversion, garnering significant global research interest. These materials are characterized by their unique structural properties, compositional complexity, entropy-driven stabilization, superionic conductivity, and low activation energy.

Which BNKT-BST/PEI nanocomposite has the highest discharged energy density?

The findings indicate that the sandwich-structured BNKT-BST/PEI nanocomposite achieves the highest discharged energy density ( $U_d$ ) of  $7.7 \text{ J cm}^{-3}$  with  $\eta$  of 80.2% when the  $E_b$  is  $650 \text{ MV m}^{-1}$  at  $150^\circ\text{C}$ .

What is the maximum discharged energy density of fabricated polymers?

The fabricated polymers containing 3.6 mol% VK units show the maximum discharged energy density of  $15.7 \text{ J cm}^{-3}$  at  $750 \text{ MV m}^{-1}$  along with an ultra-high discharging efficiency of 88%.

Are sandwich-structured nanocomposites suitable for high-temperature polymer dielectrics?

Additionally, the sandwich-structured composites show excellent cycling stability at  $500 \text{ MV m}^{-1}$  and  $150^\circ\text{C}$ , with  $U_d$  of  $4.7 \text{ J cm}^{-3}$  and  $\eta$  greater than 90%. The research presents nanocomposites with high energy storage density and excellent stability, crucial for the practical application of polymer dielectrics in high-temperature environments.

Furthermore, it displays a high-power density of  $584 \text{ MW cm}^{-3}$  and an ultrashort discharge time of 27 ns. This work presents an effective approach for designing dielectric ...

The  $\text{NaNbO}_3$  antiferroelectrics have been considered as a potential candidate for dielectric capacitors applications. However, the high-electric-field-unstable antiferroelectric phase resulted in low energy storage density and efficiency. Herein, good energy storage properties were realized in  $(1-x)\text{NaNbO}_3-x\text{NaTaO}_3$  ceramics, by building a new phase boundary.

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The energy density of the 2PA-6-800 supercapacitor is found to be between 0.93 and 5.86 Wh kg<sup>-1</sup> at a power density range of 20.0-27,250 W kg<sup>-1</sup> (SI Table S6). Thanks to its large operational voltage window and high C<sub>sp</sub>, the 2PA-6-800 ZIC demonstrates a remarkable energy density, which varies from 24.0 to 352.5 Wh kg<sup>-1</sup> (SI Table S7).

However, it is a great challenge to achieve both large energy storage density and high efficiency simultaneously in dielectric capacitors. This work investigates the energy storage performance of sol-gel-processed (K,Na)NbO<sub>3</sub>-based lead-free ferroelectric films on silicon substrates with compositions of 0.95(K 0.49 Na 0.49 Li 0.02 )(Nb 0.8 Ta 0.2 )O<sub>3</sub> ...

Rechargeable batteries of high energy density and overall performance are becoming a critically important technology in the rapidly changing society of the twenty-first century. While lithium-ion batteries have so far been the dominant choice, numerous emerging applications call for higher capacity, better safety and lower costs while maintaining sufficient cyclability. The design ...

The device showed a high energy density of 27.8 Wh kg<sup>-1</sup> at a power density of 1921 W kg<sup>-1</sup>. The authors tested the scope of the materials as flexible electrodes for solid-state supercapacitors without any hybrid cell design. The flexible capacitor showed an energy density of 3.62 Wh kg<sup>-1</sup> at 965 W kg<sup>-1</sup>.

Sun et al. developed a NiCoMn ternary cathode material with a high energy density of 206 mAh g<sup>-1</sup> and a capacity retention rate of 70.3% after 1000 cycles at 55 °C, as ... There are still many new structures, definite lithium storage ...

Based on a combination of thermally stimulated depolarization currents (TSDCs), pulsed electro-acoustic (PEA) and density functional theory analysis (DFT), the high breakdown strength, ...

The research presents nanocomposites with high energy storage density and excellent stability, crucial for the practical application of polymer dielectrics in high-temperature ...

The commercial rGO delivers an energy density of up to 1866 Wh/kg, demonstrating the potential to produce compact, high energy density batteries for electronic ...

Comparison of the operating range and energy density of two new high temperature MGA thermal storage materials. Sensible heat storage using solar salt is indicated by the blue line. The black bar on the temperature axis indicates the inlet steam temperature range for conventional sub-critical steam turbine-generators.

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