

Does grain size affect energy storage performance of polycrystalline ferroelectrics?

Jie Wang; Effect of grain size and grain boundary on the energy storage performance of polycrystalline ferroelectrics. 7 October 2024; 125 (15): 152903. Dielectric capacitors based on polycrystalline ferroelectrics have attracted much attention due to their significant power density and fast charge-discharge speed.

Does crystallographic orientation affect energy storage?

This extension depends on crystallographic orientation and naturally will entail strain misfits in the dielectric, with the resultant mechanical breakdown hindering energy storage. Now, writing in Nature Materials, Li and co-workers<sup>4</sup> went beyond the usual principles of tailoring chemical composition or microstructure.

Does polycrystalline BiFeO<sub>3</sub> ceramic have a Magnetocapacitance effect?

The present work reveals the energy storage performance and magnetocapacitance effect of polycrystalline BiFeO<sub>3</sub> ceramics. The sample is synthesized through a solid-state route, and the probable R3c phase that falls within the sensitive region is determined.

How does grain size affect energy storage density?

However, as the grain size further decreases or the grain boundary thickness further increases, the energy storage density decreases, which is attributed to the concurrent reduction in both the remnant and saturation polarizations.

What is a crystallographic brick wall design for polycrystalline dielectric ceramics?

A crystallographic brick wall design for polycrystalline dielectric ceramics now allows the application of high electric fields at minimal misfit strain, yielding supreme reliability and high energy density. The impending climate crisis requires swift action.

Does polycrystalline BiFeO<sub>3</sub> have a magnetic order?

To conclude, the energy storage performance and magnetocapacitance effect of polycrystalline BiFeO<sub>3</sub> ceramics are reported. The crystal chemistry method reveals the possibility of magnetic ordering in BiFeO<sub>3</sub> and supports the Rietveld refinement results.

The setup was designed and built by placing a commercial polycrystalline Si-based PV cell beneath the MOST system (Figures 1 B and 1C). To ensure both effective cooling and optical filter (energy storage for non-heating temperature stabilization) effects from the MOST system, on one hand, the microfluidic chip containing the flowing MOST ...

The energy storage performance of polycrystalline ferroelectrics is highly dependent on the grain size and grain boundary. Here, the effect of grain size and grain boundary on the domain structures and

polarization-electric field (P-E) hysteresis loops of polycrystalline ferroelectrics are investigated by using a phase-field model based on the time dependent Ginzburg-Landau ...

Single-crystal  $\text{Li}(\text{Ni}_{0.5}\text{Mn}_{0.3}\text{Co}_{0.2})\text{O}_2$  (SC-NMC532) was compared with their polycrystalline counterparts (PC-NMC532) in sulfide-based all-solid-state batteries. It is found that SC-NMC532 exhibits a  $\text{Li}^+$  diffusion coefficient of 6-14 times higher than PC-NMC532. Consequently, SC-NMC532 exhibits higher capacity, better rate performance.

High-energy Ni-rich NMC ( $\text{LiNi}_x\text{Mn}_y\text{Co}_{1-x-y}\text{O}_2$ ,  $x \geq 0.6$ ) is a very promising cathode material in Li-ion batteries but the gas generation during cycling is a significant safety concern and becomes the major roadblock of the large-scale commercialization of Ni-rich NMC cathode materials. Micron-sized single crystal Ni-rich NMC has a potential to address the ...

The energy storage performance of polycrystalline ferroelectrics is highly dependent on the grain size and grain boundary. Here, the effect of grain size and grain boundary on the domain structures and polarization-electric ...

Pure monoclinic-phase polycrystalline  $\text{BST}_{2-x}\text{La}$  ceramics were synthesized.  $\text{La}^{3+}$  acted as a donor dopant in the structure. Mechanism of intrinsic electronic conduction in the ceramics was deduced.  $\text{La}^{3+}$  could optimise the relaxor ferroelectric properties of  $\text{BST}_{2-x}\text{La}$  ceramics. The energy storage density and efficiency were improved at small values of  $x$ .

The energy storage density reaches  $7.8 \text{ J cm}^{-3}$ , 77 % higher than the MLCCs fabricated by traditional one-step sintering method. Moreover, the energy storage density changes by less than 10 % in a wide temperature range of  $10 \sim 180 \text{ }^\circ\text{C}$ . ... Additionally, local polycrystalline distortion effectively reduces the size of PNRs, minimizing losses ...

Current methods for enhancing the energy storage performance of multilayer films are various, including component ratio tuning [11], ... Outstanding ferroelectricity in sol-gel-derived polycrystalline  $\text{BiFeO}_3$  films within a wide thickness range. ACS Appl. Mater. Interfaces, 14 (2022), pp. 21696-21704.

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Lithium metal batteries have been deemed one of the most promising candidates for new-generation batteries, used in mobile devices, electric vehicles, energy storage, etc. However, due to the volume change of active

materials and external pressure, the electrode materials and interfaces between battery components have high stresses during the cycling ...

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