How to solve the energy storage problem of fluorite

Do fluorite-structured antiferroelectric oxides have energy storage properties?
This work reviews the energy storage properties of fluorite-structured antiferroelectric oxides (HfO 2 and ZrO 2), along with 3-D device structures, the effect of negative capacitance on the energy storage characteristics of fluorites, and the future prospects of this research field.

Why is fluorite amorphous?
The amorphous structure is owing to oxygen instabilityin between the two energetically-favorable crystalline forms,in which not only the long-range periodicities of fluorite and perovskite are collapsed but also more than one symmetry,i.e.,the monoclinic and orthorhombic,coexist in short range,giving rise to a strong structure disordering.

Does fluorite HFO 2 have a breakdown strength 12 mV/cm?
Here,by employing a new structure-evolution strategy between fluorite HfO 2 and perovskite hafnate (A HfO 3,where A is a divalent ion),we create an amorphous hafnium-based oxide that exhibits a breakdown strength as high as ~12 MV/cm.

Are fluorite-structured dielectrics suitable for nanocapacitors?
Recently,ferroelectric and antiferroelectric fluorite-structured dielectrics (e.g.,zirconia and hafnia) have been studied intensively for data storage and energy-related applications. Their nanoscale (nm) thickness makes these materials suitablefor use as nanocapacitors in MEASs.

What is the energy density of fluorite HfO2 and perovskite hafnate?
Here,by structure evolution between fluorite HfO2 and perovskite hafnate,we create an amorphous hafnium-based oxide that exhibits the energy density of ~155 J/cm3with an efficiency of 87%,which is state-of-the-art in emergingly capacitive energy-storage materials.

What is a fluoride ion battery?
Fluoride ion batteries (FIB) provide an interesting alternative to lithium ion batteries,in particular because of their larger theoretical energy densities. These batteries are based on a F anion shuttle between a metal fluoride cathode and a metal anode. One critical component is the electrolyte that should provide fast anion conduction.

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