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Thermally Stable Highly Efficient Energy Density 10BiScO3-90BaTiO3 Thin Film Capacitor obtained Via A-site vacancy plus rotator crystal strategy

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Abstract

Competing the stable energy density with high efficiency against varying temperature of the lead-based ceramic capacitors is a big challenge for lead-free applications. Different approaches have been used to overcome this problem: multilayer structure with interface effect and defect engineering and microstructure control are best of them.

This study presents a ground-breaking strategy to improve the energy storage performance in BiSc-based lead-free ceramics thin films. Here we investigated the recoverable energy storage properties of rotator(110-textured) crystals of A-cations deficient 10BiScO3-90BaTiO3(10BSBT) thin films deposited on platinized-silicon(Pt-Si) substrate by using pulsed laser deposition (PLD) technique. It is revealed that the synergistic effects of (110)-textured (rotator effect) with the A-site vacancies got superior recoverable energy storage performance even double the reported morphotropic phase boundary(MPB) of 40BiScO3-60BaTiO3 epitaxial thin film(100%(100)-textured) with outstanding thermal stability and breakdown strength(BDS). The results indicate that the Wr of the (110)-strong textured with A-site vacancy of 10BSBT thin film increases linearly (up to ~28.8 J/cm3) and efficiency decreases slightly (97%-92%) with the increasing of electric field E(0.29-2.8 MV/cm) at 25oC, while Wr of ~25 J/cm3 remains nearly temperature independent in the range of 25oC to 200oC under the E of ~2.57 MV/cm with the weakly temperature dependent efficiency >80%. The stable energy density and breakdown strength against varying temperature is one of the best reported in lead-based thick/thin films ceramic capacitors with the highest efficiency according to the best of our knowledge.

Biography:

As I finished my MS in Experimental Physics Electronics From the Xi'an Jiaotong University, Xi'an, Chia. My main research work has been related to Organic-inorganic hybrid, Perovskite thin film solar cell. Now I am 3rd year PhD student in City university of Hong Kong doing research on led-free perovskite, ferroelectric thin films for enrgy storage Capacitors. I have one Publication in ACS Applied Materials & Interfaces.

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