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Giant electrocaloric effect found in the relaxor PLZST thin films with the coexistence of antiferroelectric and ferroelectric phases in a broad temperature range

Large electrocaloric (EC) effect with a broad operational temperature range is required and attractive in solid-state cooling devices. In this work, a giant *EC* effect (ΔT~20.7K) in a broad temperature range (~ 110 K) was demonstrated in relaxor antiferroelectric (AFE) $Pb_{0.97}La_{0.02}(Zr_{0.65}Sn_{0.3}Ti_{0.05})\ O_3$ (PLZST) sol-gel thin film. The use of the $LaNiO_3$/Pt composite bottom electrode may cause the in-plane residual thermal tensile stress during the layer-by-layer annealing process, which may be responsible for the large positive EC effect. The coexistence of nanoscale multiple FE and AFE phases leads to the great dielectric relaxor dispersion around the dielectric peak, which may be ascribed to the broad EC operational temperature range. These newly-discovered properties in the PLZST thin films suggest this multifunctional material having a great potential for applications in modern solid-state cooling.

Speaker Biography

Qi Zhang is a senior lecturer in Cranfield University, UK and a professor in Wuhan University of Technology, Wuhan, China. He has his expertise in functional materials. He was one of the initiators of the thin film electrocaloric effect, which could develop. He has authored or co-authored over 200 papers, edited one book and 10 book chapters. He has an h factor of 30. He is a fellow and charted scientist in IOM3. His main areas of research are within synthesis of nanomaterials for electrochemical energy storage, fabrication of transparent conducting thin films and sol-gel synthesis and structural characterization of ferroelectric thin films for electrocaloric cooling. He was the recipient of the Royal Society Brian Mercer Feasibility Award.

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