PZT セラミックス, PVDF, PMN-PT 結晶の電気熱量効果

Electrocaloric Properties of PZT-based Ceramics, PVDF, and PMN-PT Crystals

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The electrocaloric effect(ECE) is a phenomenon in which a material shows a reversible temperature change under an applied electric field. In order to create ECE cooling devices, materials with large ECEs are required. In this study, the sample temperature changes derived from ECE under bipolar electric field were directly measured. $Pb(Zr,Ti)O_3$ (PZT)-based ceramics with various Tcs, PolyVinylidene DiFluoride (PVDF) films, $Pb(Mg_{1/3}Nb_{2/3})O_3$-$PbTiO_3$(PMN-PT) crystals were used as samples. The temperatures of these samples were periodically changed by application of alternating electric field applications. The temperature change exhibited butterfly-shaped hystsresis loops with the field. Figure 1 shows the strain-electric field (S-E) loops and the temperature-electric field (T-E) loops of the PZT-based ceramics (a) hard PZT with Tc of 330 °C, (b) soft PZT with Tc of 190 °C, and (c) soft PZT with Tc of 140 °C are shown in Figure 1. The comparison with the estimations from indirect approach based on Maxwell's equation will be discussed.

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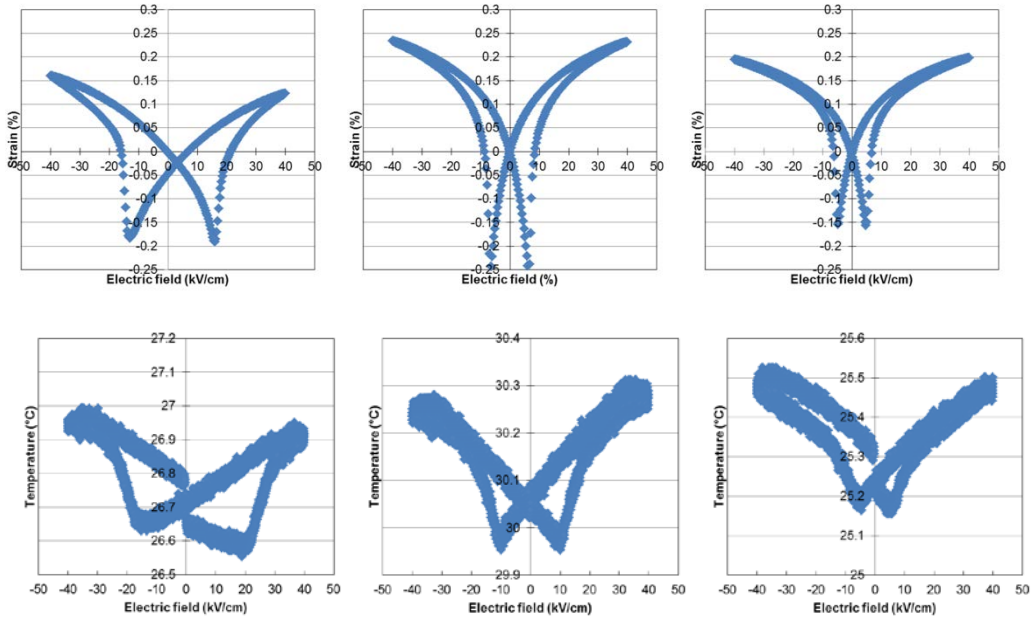

(a) hard PZT with Tc of 330 °C (b) soft PZT with Tc of 190 °C (c) soft PZT with Tc of 140 °C

Fig1. Strain-electric field (S-E) loop (above) and temperature-electric field (T-E) loop (below) of the PZT-based ceramics.