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PZT 系セラミックス, $BaTiO_3$ 系セラミックスの電気熱量効果

Electrocaloric Properties of PZT-based and BT-based Ceramics

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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. There are some problems with conventional refrigerators. Since the conventional refrigerator operates by using a compressor, vibration is inevitable. Conventional refrigerators also use Freon as refrigerants; however, the use of Freon has been implicated in ozone depletion. Other disadvantages include the difficulty of downscaling. Thermoelectric cooling is possible using a Peltier device, considered a solid-state cooling device; however, low efficiency has been a hindrance to wider application. From the viewpoint of innovation in refrigeration, cooling based on new mechanisms is expected. ECE is considered to be one of these new cooling mechanisms.

In terms of direct measurement of the ΔT, there are some difficulties. Reports on the direct measurement of ΔT have been limited thus far, probably due to the difficulties. In this study, the electrocaloric temperature change, ΔT, due to applied ΔE was calculated measured directly. Figure 1 shows the Poplarization-electric field (P-E), strain-electric field (S-E) loops and the temperature-electric field (T-E) loops of the $Ba(Zr_{0.2}T_{i0.8})O_3$ ceramics The comparison with the estimations from indirect approach based on Maxwell's equation will be discussed.

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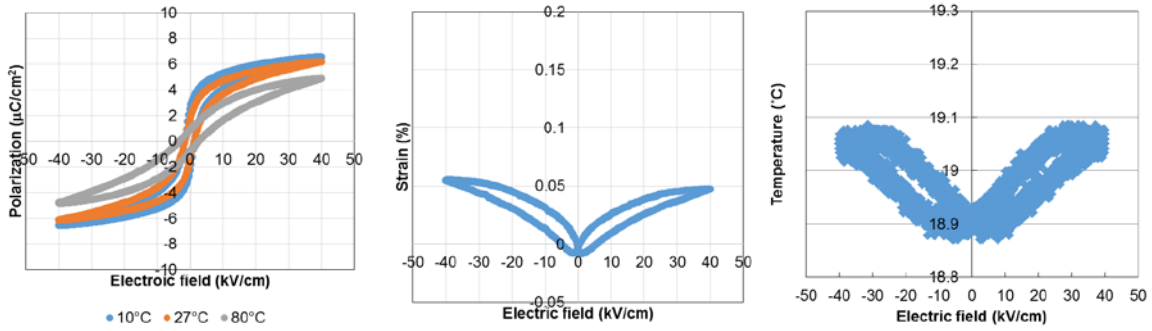

Fig. 1. Polarization-electric field (P-E), strain-electric field (S-E) loop and temperature-electric field (T-E) loops of the $Ba(Zr_{0.2}T_{i0.8})O_3$ ceramics.