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Characterization of oxygen-vacancy-related relaxation by thermally stimulated depolarization current and impedance spectroscopy

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The correlation between dielectric relaxation processes and oxygen vacancy defects has been investigated by thermally stimulated depolarization current (TSDC) measurement and impedance spectroscopy (IS) analysis.

As a result of the variations of peak current intensity and peak temperature with different polarization temperatures in the TSDC curves of antiferroelectric ceramics, three successive relaxation peaks with different origins have been found to occur: a low-temperature defect dipoles peak, an intermediate-temperature in-grain oxygen vacancy migration peak, and a high-temperature transgranular oxygen vacancy migration peak. These results demonstrated that the improved resistance degradation process with the increase of barium substitution is related to the decrease in oxygen vacancy concentration.

The effect of thermal annealing atmosphere on the dielectric properties of barium strontium titanate ($(Ba,Sr)TiO_3$, BST) glass-ceramics was investigated by IS and TSDC methods. The thermal annealing atmosphere variation was shown to be sensitive to oxygen vacancy concentration. It is shown that the oxygen vacancy concentration of the N_2-sintered samples is much higher than that of air-annealed and O_2-annealed glass-ceramic samples.

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