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Antiferroelectrics for energy storage application-perspectives for processing and characterization

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The effect of composition modifications on phase development, dielectric property and energy storage performance of $(Pb_{0.925}\text{-}xLa_{0.05}Ba_x)(Zr_{0.52}Sn_{0.39}Ti_{0.09})O_3$ (PLBZST) antiferroelectric ceramics was investigated. The energy storage performance of the barium doped antiferroelectric ceramics was studied by measurements of polarization hysteresis loops and charge-discharge measurements. X-ray diffraction patterns and scanning electron microscopy micrographs illustrated that the pyrochlore phase was effectively suppressed by the introduction of barium in the antiferroelectric ceramics. The increase in maximum dielectric constant and the decrease in both transition temperature and switching field with increasing barium content were due to the decrease in the stability of antiferroelectric phase. In addition, with increasing titanium content, the tolerance factor was increased, resulting in the decreased stability of antiferroelectric phase in the ceramics. As the titanium content increased, the maximum dielectric constant increased and the temperature of the dielectric maximum shifted to lower temperatures. As a result of polarization-electric field hysteresis loops, both charged energy densities and discharged energy densities increased consistently with the increase of titanium content. From the charge-discharge measurements, released energy densities and power densities as a function of discharge time were determined over the investigated composition ranges.