Structure, Ferroelectric and Mechanical Performance of Polycrystalline Gadolinium Doped lead Lanthanum Zirconate Titanate Ceramics

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Gadolinium doped lead lanthanum zirconate titanate $(Pb_{0.94-x}Gd_xLa_{0.06})(Zr_{0.52}Ti_{0.48})O_3$: PLGZT ceramics with x= 0, 2, 4, 6, and 8% were synthesized using a sol-gel auto combustion method. A pure perovskite PLGZT was obtained for the powder calcined at 850℃ for 3h. The specimens were fabricated and studied to understand the effect of Gd^2+ substitution on the microstructure, ferroelectric and mechanical properties. We have executed Rietveld analysis of x-ray powder diffraction data of PLGZT near the morphotropic phase boundary (MPB). The tetragonal and rhombohedral phases were found to coexist at room temperature. The remnant polarization P_r and coercive field E_c were calculated from the ferroelectric loop. The elastic constants were determined for the samples by ultrasonic wave propagation to determine the elastic behavior of the dopant on the PLZT matrix. The results show that Gd doping in the A-site of the ABO_3 perovskite system improves the hysteresis behavior. In the same manner, Gd doping enhances its mechanical properties.