Enhanced Dielectric and Piezoelectric Properties of the $BiFeO_3$-$PbTiO_3$-$BaZrO_3$ Ternary High Curie Temperature Ceramics

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$BiFeO_3$-$PbTiO_3$-based solid solutions have been investigated for the development of piezoelectric ceramics with high Curie temperatures. It is observed that with the mix of the third component $BaZrO_3$, the dielectric loss is decreased and piezoelectric property is highly improved compare with the $BiFeO_3$-$PbTiO_3$(BF-PT) binary system. In this paper, $BiFeO_3$-$PbTiO_3$-$BaZrO_3$ (BF-PT-BZ) solid solutions with composition of xBF-(0.95-x)PT-0.05BZ(x=0.60,0.62,0.63,0.64,0.66) were synthesized via solid-state reaction method. Samples calcined at 1020^{o}C exhibit high density and pure phase. The grain size of xBF-(0.95-x)PT-0.05BZ is in the range from 10- 22 μm. Values of dielectric constant ε_r of xBF-(0.95-x)PT-0.05BZ increased to 265 and then decreased while the loss tanδ is on the contrary when the $BiFeO_3$(BF) content varies from 0.60 to 0.66 at low frequency. The T_c is from550^{o}C to 560^{o}C with the increasing content of BF. xBF-(0.95-x)PT-0.05BZ ceramics for x=0.63 is around the morphotropic phase boundary(MPB), exhibiting most saturated polarization, with remnant polarization P_r of 43.2 μC/cm^2 and coercive field E_c of 61.6 kV/cm. The values of d_{33}, k_p and Q_m of 0.63BF-0.32PT-0.05BZ are 118 pC/N, 0.322 and 501 respectively, showing tremendous potential for high Curie temperature piezoelectric applications.

References

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