Effect of Post-annealing temperature and time in BaTiO₃-Bi(Mg_{1/2}Ti_{1/2})O₃-BiFeO₃ piezoelectric ceramics

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The BiFeO₃-based lead-free piezoelectric ceramics such as BiFeO₃-BaTiO₃ (BF-BT) and BaTiO₃-Bi(Mg_{1/2}Ti_{1/2})O₃-BiFeO₃ (BT-BMT-BF) have been intensively studied, because they have high Curie Temperature (T_c) and increased piezoelectric properties [1,2]. However, the piezoelectric properties were lower than those of Lead-Zirconate-Titanate (PZT), possibly due to the presence of charged defects and resultant defect dipoles [3].

In this work, the effect of annealing temperature, keeping annealing time and quenching process on the ferroelectric and piezoelectric properties were investigated for Mn-added 0.3BaTiO₃-0.1Bi(Mg_{1/2}Ti_{1/2})O₃ -0.6BiFeO₃ (0.3BT-0.1BMT-0.6BF) piezoelectric ceramics. The BT-BMT-BF ceramics were prepared by solid-state synthesis of BaTiO₃ (BT), BiFeO₃ (BF), Bi₂O₃, MgO, TiO₂ powders. The ceramics were post-annealing at T_a =600~1000°C for 5~20h, and then furnace-cooled or quenched to room temperature.



Figure 1. The remanent polarization and coercive field value at various annealing temperatures and times (all samples quenched after finished annealing process)

Figure 1 shows annealing temperature and time dependence of the remanent polarization and coercive field. Ferroelectric properties observed strongly depend on the annealing temperature, but not on annealing time. Piezoelectric properties, grain size, relative density and so on as a function of annealing temperature and time will be also presented.

[References]

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