Fabrication and Characterization of La, Ga Co-modified $BiFeO_3$-$PbTiO_3$ Multiferroic Ceramics with High Magnetic Field Assisted Sintering

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The $BiFeO_3$-$PbTiO_3$ (BF-PT) multiferroic ceramics has attracted broad attention due to the excellent performance and a wide range of potential applications. However, it is crucial to apply a favorable synthesis and sintering method in the process of ceramics preparation. Up to date, there is rarely any report on the effect of high magnetic field assisted sintering on BF-PT based samples.

In this work, the polycrystalline $0.57(Bi_{0.8}La_{0.2})(Ga_{0.05}Fe_{0.95})O_3$-$0.43PbTiO_3$ (BLGF-PT) ceramics were prepared by the solid-state reaction method, whose calcination and sintering process were carried out under the magnetic field from 0 T to 8 T. The effect of magnetic field intensity on the phase structure, grain size, dielectric and piezoelectric properties of BLGF-PT were investigated systematically. The results indicate that the high magnetic field assisted sintering exerts considerable impact on the structure and performance of ceramics. BLGF-PT ceramics exhibit the more densified microstructure after sintering under the high magnetic field of 8 T (Figure 1). The magnetic field assisted sintered BLGF-PT ceramics have the dielectric loss of 0.03 at the frequency of 100 Hz, much lower than that of 0.16 for the specimen without using the magnetic assisted sintering. Furthermore, the BLGF-PT ceramics sintered under the high magnetic fields exhibit the enhanced dielectric, ferroelectric, and piezoelectric properties. Our results indicate that the high magnetic field assisted heat treatment is a promising technology to improve some crucial properties of BLGF-PT ceramics.

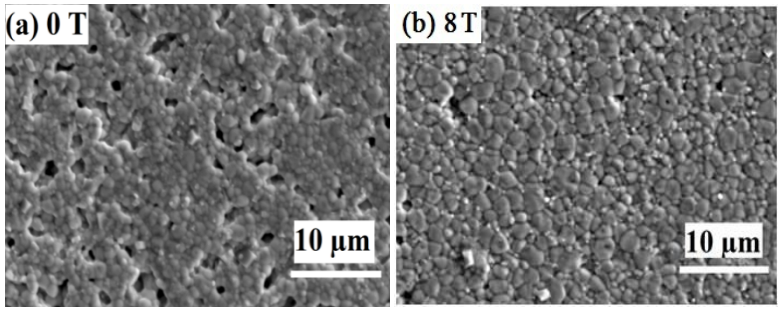

Figure 1.SEM images of BLGF-PT ceramics sintered under the magnetic field of (a) 0 T and (b) 8 T