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The effects of MnO_2 addition on the structure and dielectric properties of the strontium barium niobate glass-ceramics

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Highlights:

- (1). A small amount of MnO_2 doping the SBN-glass-ceramics makes BDS reach to 1470.6 kV/cm
- (2). The theoretical energy storage density of the SBN-glass-ceramics with MnO_2 addition gets 9.2 J/cm^3.
- (3). A small amount MnO_2 doping the BSN-glass-ceramics makes the leakage current densities decrease to 10^{-6} A/cm^2. And a small amount of MnO_2 doping the SBN-glass-ceramics can effectively decrease the dielectric loss of the materials.

Abstract

The effects of MnO_2 content on the structure and dielectric properties of the SBN-glass-ceramics were studied. The results show that a small amount of MnO_2 doping of the SBN-glass-ceramics can make their microstructure become denser and more uniform and MnO_2 doping of the SBN-glass-ceramics, as a grain growth inhibitor, has an evident effect on the reduction of grain sizes. The Mn ions exist in the form of Mn^{3+} and Mn^{4+} ions in the SBN-glass-ceramics, as confirmed by XPS measurements and Mn^{3+} and Mn^{4+} ions easily form charge defect complexes, which causes the leakage current densities of the SBN-glass-ceramics to obviously decrease. And a small amount of MnO_2 doping of the SBN-glass-ceramics can effectively decrease the dielectric loss of the materials. When 0.05 mol% MnO_2 is added to the SBN-glass-ceramics, the BDS is up to 1470.6 kV/cm and the theoretical energy storage density reaches the maximum value of 9.2 J/cm^3.