

Structural and dielectric properties of iron doped barium strontium titanate for storage applications

ABSTRACT

Barium strontium titanate (BST) and iron doped barium strontium titanate (BSTF) ceramics with general formula $(\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Ti}_{1-y}\text{Fe}_y\text{O}_3)$ and different iron (Fe) contents were prepared by slow rate injection sol-gel technique. The phase analysis, morphology and dielectric properties of BSTFs were investigated. The phase analysis was carried out using XRD which revealed the crystallization of BSTF in perovskite structure with single phase. The Fe doped BST peaks shifted toward higher angles and the calculated crystallite size was 19 nm on average. The BSTF morphology was studied using TEM which showed that the particle size was affected by Fe content. The average particle size was found to be 37 nm for $(\text{Ba}_{0.5}\text{Sr}_{0.5}\text{Ti}_{1-y}\text{Fe}_y\text{O}_3)$ with Fe concentration of ($y = 0.01, 0.05$ and 0.1) calcined at (600, 800 and 1000 °C). The dielectric measurements were carried out using impedance analyzer at room temperature as a function of frequency in the range of 10 Hz to 1 MHz. The dielectric constant and dielectric loss of the 1 mol% Fe-doped $\text{Ba}_{0.5}\text{Sr}_{0.5}\text{TiO}_3$ at 1 kHz were 1453.69 and 0.0063, respectively. The BSTF ceramics with high dielectric constant and low dielectric loss were obtained for the application DRAM cell capacitor.

Keyword: Barium strontium titanate (BST); Dielectric properties