

Structural, electrical and magnetic properties of $\text{BiFe}_{1-x}\text{Y}_x\text{O}_3$ ($0 \leq x \leq 0.6$) ceramics

ABSTRACT

The effect of Y substitution on the microstructure, dielectric, magnetic and leakage current properties of $\text{BiFe}_{1-x}\text{Y}_x\text{O}_3$ ($0 \leq x \leq 0.6$) ceramics was investigated. The BiFeO_3 phase that is dominant at $x = 0.0 - 0.2$ decreased with the increase of Y substitution. Other phases such as YFeO_3 and $\text{Bi}_{1.46}\text{Y}_{0.54}\text{O}_3$ emerged with Y substitution and became dominant in the range $x = 0.3 - 0.4$ and $0.5 - 0.6$, respectively. The $\text{BiFe}_{1-x}\text{Y}_x\text{O}_3$ composites of rounded shape grains at $x = 0.0$ deformed at $x = 0.1 - 0.3$ and changed to melted-like grains at $x = 0.4 - 0.6$ with the incorporation of smaller grains at $x = 0.5$ and 0.6 . The sample with $x = 0.2$ had the highest remnant magnetization ($M_r = 0.09$ emu/g) and saturation magnetization ($M_s = 2.9$ emu/g). The sample with $x = 0.4$ showed the highest dielectric constant of 104 and lowest loss tangent of 1.34×10^{-4} . The leakage current was significantly reduced to a lower value of 2.80×10^{-8} A/cm² at $x = 0.6$.

Keyword: Bismuth ferrite ceramic; X-ray diffraction; Solid-state reaction; Magnetic properties; Dielectric properties