

A Case Study of Effect of Polymer in Bismuth Ferrite (BiFeO_3) Multiferroics Nano Composite Thin Film

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Abstract: To control the magnetic properties is of great importance in Multiferroics based devices. Bismuth ferrite is synthesized by sol gel auto combustion method and x ray characterization is performed on prepared nano particles to show the purity of phases. Polymer based thin film is prepared by tape casting method after dispersing the different concentration of nano particles. Magnetization analysis is reviewed on the prepared polymer composite.

Keywords: Multiferroics, magnetization, sol gel auto combustion process, etc

1. Introduction

Multiferroics [1] is the material which possesses more than one ferroic ordering. It composed of both ferroelectric and ferromagnetic to show coupled magneto electric effect. Recent development has brought various nano material multiferroics composite in application due to excellent properties. BiFeO_3 is the most usable multiferroics composite. It has excellent ferroelectric properties but weak ferromagnetic properties. [2] So in present work our main objective is to increase its ferromagnetic properties. I have reviewed various research paper that how to increase its magnetic properties. One of the most adoptable methods is by forming a thin polymer composite by using nano particles [3] By using polymer, magnetization is increased due to that magneto electric effect is also increased [4].

2. Experimental discussion

Bismuth ferrite is prepared by sol gel auto combustion process. It is prepared by using the nitrates of bismuth and iron. $\text{Bi}(\text{NO}_3)_3 \cdot 5\text{H}_2\text{O}$ and $\text{Fe}(\text{NO}_3)_3 \cdot 9\text{H}_2\text{O}$ is poured in water and heat it up to 70°C for 45 minutes till full mixing with magnetic stirring. Now both solutions are mixed and now it is heated at 180°C till gel is formed. After the formation of gel, combustion takes place and fluffy powder will form. Now combustible powders are ground in mortar and convert in nano size.

Thin film is prepared by tape casting method by using polymer powder, chloroform (CHCl_3) and some quantity of BiFeO_3 nano particles.

3. Results and discussions

- **XRD:** X ray diffraction analysis of prepared nano particles and thin film is performed and found that no extra phase is present. It confirms that our prepared film is pure and no impurity is present.[5]
- **Magnetization:** magnetization analysis is performed on the prepared thin film of various concentrations of nano particles on SQUID magnetometer [6]. It is found that magnetization is increased as the concentration of nano particles is increased.

4. Conclusion and future scope

Thin film nano composite film is prepared by sol gel auto combustion process. XRD analysis of thin film confirms that no impurity phase was found. Enhanced magnetization is found after the magnetization analysis. Due to enhanced magnetization magneto electric effect is also observed. Conductivity is lowered after the formation of thin film.

A. Future scope

By doping rare earth ions in BiFeO_3 and forming thin film composite will improve the other properties of BiFeO_3 which increase its application areas in electronics, mechanical or electrical industries.

References

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