UNIVERSITI TEKNOLOGI MARA

EFFECT OF GALLIUM SUBSTITUTION ON THE STRUCTURAL, DIELECTRIC AND MAGNETIC PROPERTIES OF BISMUTH FERRITE

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ABSTRACT

Gallium doped in Bi-site of $Bi_{1-x}Ga_xFeO_3$ (BGFO) ceramic with x = 0.00, 0.01, 0.02 and 0.03 was synthesized by using solid state reaction method. The prepared samples were calcined at 825°C for 2 hours. In this study, the effect of Gallium substitution at A-site on the structural and dielectric properties were investigated by using X-ray Diffractometer (XRD), Scanning Electron Microscope (SEM) and Electrical Impedance Spectroscopy (EIS). Furthermore, magnetic properties of Bismuth Ferrite (BFO) and BGFO were studied by using Vibrating Sample Magnetometer (VSM). The substitution of Ga^{3+} which possess smaller ionic radius compared to Bi^{3+} could help in reducing volatility, enhanced dielectric properties and increased the magnetization values. XRD analysis revealed single phase nature until 0.02 Gallium concentrations and there was no structural changes as Ga dopant had entered the BFO structure. On the Ga^{3+} substitutions for microstructural analyses indicate the grain reductions as well as more uniformly distribution grain were observed by using SEM. Meanwhile, the influence of Gallium substitution on dielectric measurements was examined by using EIS at room temperature with frequency ranging up to 1MHz and the dipole relaxation phenomenon can be seen in all samples un-doped BFO and Gallium doped samples. Furthermore, Gallium doped to the BFO system showed significant enhancement in dielectric constant and dissipation factor. The magnetic studies were analyzed by using VSM where M-H hysteresis loop on Ga^{3+} ion substitution shows the enhancement in saturation magnetization at room temperature up to magnetic field 6 kOe compared to un-doped Bismuth Ferrite which antiferromagnetic behavior was observed.

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TABLE OF CONTENT

	Page
CONFIRMATION BY PANEL OF EXAMINERS	**ii**
AUTHOR'S DECLARATION	**iii**
ABSTRACT	**iv**
ACKNOWLEDGEMENT	**v**
TABLE OF CONTENT	**vi**
LIST OF TABLES	**ix**
LIST OF FIGURES	**x**
LIST OF SYMBOLS	**xii**
LIST OF ABBREVIATION	**xiii**
CHAPTER ONE : INTRODUCTION	**1**
1.1 Research Background	1
1.2 Problems Statement	5
1.3 Objectives of The Research	6
1.4 Scope of The Thesis	6
1.5 Significant of The Study	7
CHAPTER TWO : LITERATURE REVIEW	**8**
2.1 Overview	8
2.2 Technology And Appplication	9
2.3 Ferroic Properties	12
2.3.1 Ferroelectricity	12
2.3.2 Multiferroic	16
2.4 Perovskite Structure of Bismuth Ferrite	20
2.5 Doping of Bismuth Ferrite	22
2.6 Synthesis of Bismuth Ferrite	32
2.6.1 Solid State Method	32