MICROSTRUCTURE AND DIELECTRIC PROPERTIES OF $BiFeO_3$ CO-DOPING WITH Eu AND La

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ABSTRACT

MICROSTRUCTURE AND DIELECTRIC PROPERTIES OF $BiFeO_3$ CO-DOPING WITH Eu AND La

$BiFeO_3$ doped with Eu_2O_3 and La_2O_3 were prepared by the conventional solid-state reactions method. The effect of La and Eu substitution for the studies on dielectric properties of $Bi_{1-x-y}Eu_xLa_yFeO_3$ samples (x=0.2; y= 0.1, 0.2) has been studied by performing x-ray diffraction (X-RD), scanning electron microscopy (SEM) and electrical impedance spectroscopy (EIS). The results of prepared samples are compared with pure $BiFeO_3$ and the single doping of $Bi_{1-x}Eu_xFeO_3$ samples (x=0.1, 0.15, 0.2). Result showed that the grain size decreasing when the concentration of $Bi_{1-x-y}Eu_xLa_yFeO_3$ samples is increased. X-ray diffraction (XRD) patterns showed that single phase was formed for all samples. The dielectric constant and the dielectric loss is decreasing as the as the frequency is increase from 1 kHz to 1 MHz at 30°C.

CHAPTER 1

INTRODUCTION

1.1 Background study

Ferroelectric materials possess a spontaneous polarization that is stable and can be switched hysteretically by an applied electric field; antiferroelectric materials possess ordered dipole moments that cancel each other completely within each crystallographic unit cell. Ferromagnetic materials possess a spontaneous magnetization that is stable and can be swithched hysteretically by an applied magnetic field; antiferromagnetic materials possess ordered magnetic moments that cancel each other completely within each magnetic unit cell (Zhao et al., 2008).

Multiferroic oxides have the unique properties of both ferromagnetism and ferroelectricity in a single crystal. This opens broader applications in transducers, magnetic field sensors and information storage industry. The bismuth ferrite, $BiFeO_3$ (BFO) is the only material which gives ferroelectricity and antiferromagnetism at room temperature. $BiFeO_3$ is the only prototype among all other multiferroic oxides which shows both ferromagnetism and ferroelectricity in a single crystal above room temperature. It has ferroelectric Curie temperature, T_c = 1143K and antiferromagnetic Neel temperature, T_N = 643K (Scott *et al.*, 2009).