EFFECTS OF Cr SUBSTITUTION AT Ti-Site ON DIELECTRIC PROPERTIES OF $CaCu_3Ti_4O_{12}$ (CCTO)

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TABLE OF CONTENTS

ABSTRACT

EFFECTS OF Cr SUBSTITUTION AT Ti-Site ON DIELECTRIC PROPERTIES OF $CaCu_3Ti_4O_{12}$ (CCTO)

The study of effect of Cr substitute at Ti-Site on $CaCu_3Ti_4O_{12}$ CCTO will be carried out. From previous report shows that $CaCu_3Ti_4O_{12}$ CCTO has been found to show that it has very high dielectric constant at room temperature. This characteristic makes it potentially useful for important applications in microelectronics and memory devices. However, the dielectric loss of material is become less useable. According to this problem, this project Cr substitute at Ti-Site on $CaCu_3Ti_4O_{12}$ CCTO to lower the dielectric loss. The Cr substitute at Ti-Site on CCTO was prepared by using solid state reaction method. The Cr substitute at Ti-Site on CCTO, calcining at 1000°C for 12 hours, grinding and pellet pressing, and then sintered in air at 1100°C for 24 hours. The microstructure of the sample will be investigated by using Scanning Electron Microscope (SEM). From the microstructure, it shows that when the substitution of Cr at Ti-site was increased from pure to x=0.50, it can be seen that the grain size become much smaller. X-ray diffractometer is employed to determine phase of compound of the samples. From the result, it is single phase and the sample is crystalline. The Electrical Impedance Spectroscopy (EIS) is used to measure electrical behavior of each sample. The substitution of Cr at Ti-site on CCTO was improved their dielectric constant and dielectric properties.

CHAPTER 1

INTRODUCTION

1.1 Background

Nowadays, $CaCu_3Ti_4O_{12}$ (CCTO) has attracted much attention according to its high dielectric constant (ε_r') and CCTO has a body-centered cubic perovskite-related structure for possible technological applications. With the shrinking of dimensions of microelectronic devices, high dielectric constant is an important role in microelectronics because they can be used as important devices such as dynamic random access memory (DRAM) based on capacitive elements. Low frequency studies not covered dielectric constant up to 80,000 that are nearly constant over wide temperature range (100-600K). This unique property makes CCTO a good material for capacitor applications and certainly for microelectronics, microwave devices (such as cell mobile phones). If it is above the critical frequency that ranges between 10Hz and1MHz, the dielectric constant value depends on temperature. Majority of the CCTO studies have been performed on grains (ceramics or single crystal) (Sabar D. Hutagalung, 2008).

Impedance spectroscopic (IS) data including on CCTO ceramics demonstrated their electrical heterogeneous nature with semiconductive grains and highly resistive grain boundaries and large ε_r' was showed to grain boundary and barrier layer capacitance effects. According to B. Shri Prakash et.el ε_r'of CCTO was reported to be easy influenced on