EFFECT OF ANNEALING PROCESS ON DIELECTRIC PROPERTIES OF SOL-GEL DERIVED LEAD TITANATE THIN FILM

Thesis is presented in partial fulfillment for the award of the Bachelor of Electrical Engineering(Hons)

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ACKNOWLEDGEMENT

First and foremost, I would like to express my deep and sincere gratitude to my supervisor, Ms. Raudah Abu Bakar for her advice, guidance and encouragement throughout the research. Her wide knowledge and her logical way of thinking have been of great value for me. Her understanding, encouraging and personal guidance have provided a good basis for the present thesis. I also would like to express my warm and sincere thanks to members of Nano-SciTech Centre and Solar Cell Laboratory especially Mr. Azlan, Mr. Hafiz, Mr. Musa, Mr. Azman, Mr. Faizal and Mr. Suhaimi for their assistance in the lab. Many thanks to Mr. Khatab and Mr. Azrin for their guidance in using four-point probe measurement and LCR meter. During this work I have collaborated with many colleagues for whom I have great regard, and I wish to extend my warmest thanks to all those who have helped me with my work, Nor Syazwani, Akmal Hakim, and Nor Amalina. I also would like to thank Universiti Teknologi MARA and Jabatan Perkhidmatan Awam Malaysia for the scholarship and financial support. Finally, I would like to express my deepest thanks to my mother, , father, Abu Bakar Jusoh, sister, Susilawati, and brother, Nizam for their encouragement, understanding and support during my entire research.

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May 2010

ABSTRACT

The PT thin films have been deposited on silicon substrates using sol-gel spin coating method. The dielectric properties of the thin films annealed at different annealing temperatures and times were then investigated. The dielectric properties and resistivity of the film was measured using LCR meter and four point probe respectively. The relationship between dielectric constant and tangent loss were observed. The dielectric constant exhibits inverse relationship with tangent loss and strongly affected by annealing time and temperature. High annealing temperature caused high dielectric constant and low tangent loss. In this research, samples annealed at 700°C resulted in dielectric constant and loss of 44 and 0.1 respectively. The resistivity of the films was measured to be $1.34x10^4$ Ωm.

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CHAPTER 1

INTRODUCTION

1.1 PROJECT OVERVIEW

Due to the emergence of microelectronic technology, smaller electronic devices are highly in need. This will lead to the scaling of dimensions of the key component of CMOS devices. The reduction of device dimension allows the integration of a higher number of transistor on a chip which enable higher speed and reduced cost. The thickness of the dielectric layer need to be reduced in order to produce smaller electronic devices. This can be achieved by using thin dielectric layer or high dielectric constant material. The most widely used material for dielectric layer are SiO_2 and Si_3N_4.

Recently, several studies have been carried out to investigate the performance of ferroelectric materials as the alternative insulator. This is maybe due to their high dielectric constant properties. One of the most promising ferroelectric materials is lead titanate (PT) thin films. Since electrical and dielectric properties of thin films are highly dependent on frequencies, it is therefore essential to investigate the performance of these films in a wide range of frequency.