

**STUDY ON THE TARGETS FOR PZT THIN FILMS FABRICATION PROCESS  
USING RF REACTIVE SPUTTERING**



**INSTITUT PENYELIDIKAN, PEMBANGUNAN DAN PENGKOMERSILAN  
UNIVERSITI TEKNOLOGI MARA  
40450 SHAH ALAM, SELANGOR  
MALAYSIA**

**BY :**

**SUKREEN HANA HERMAN  
ABDUL KARIMI HALIM**

**FEBRUARI 2006**

Tarikh : 27 Februari 2006  
No. Fail Projek : 600-IRDC/ST 5/3/ 853

Penolong Naib Canselor (Penyelidikan)  
Institut Penyelidikan, Pembangunan dan Pengkomersilan (IRDC)  
UiTM, Shah Alam

Puan,

**LAPORAN AKHIR PENYELIDIKAN 'STUDY ON THE TARGETS FOR PZT THIN FILMS FABRICATION PROCESS USING RF REACTIVE SPUTTERING'**

Merujuk kepada perkara di atas, bersama-sama ini disertakan 3 (tiga) naskah Laporan Akhir Penyelidikan bertajuk 'Study on the Targets for PZT Thin Films Fabrication Process Using RF Reactive Sputtering' oleh kumpulan Penyelidik dari Fakulti Kejuruteraan Elektrik untuk makluman pihak puan.

Sekian, terima kasih.

Yang benar,

  
**SUKREEN HANA HERMAN**  
Ketua  
Projek Penyelidikan

## ABSTRACT

The purpose of this research is to conduct a thorough study on the targets for PZT thin films fabrication process. The targets play a very important role on determining the films composition and quality, thus by conducting a thorough study on the targets, will improve the process efficiency and also the films quality.

PZT thin films are widely used as the material for electronics devices, especially for Ferroelectric Random Access Memory (FeRAM). Thus research and studies on PZT has been conducted extensively. However, since lead that contained in PZT is hazardous to health and environment, studies has been conducted to develop lead-free materials to replace PZT, but still PZT has the best characteristics that suits the electronics devices. To overcome the lead problem in PZT, research has been done to reduce the lead usage during PZT fabrication process.

From this study, it is confirmed that  $PbO_2$  target is an efficient oxygen supply during PZT fabrication process. By using  $PbO_2$  target, lead amount during the process can be reduced, and also oxygen gas amount can be reduced that will results in a simpler and faster process.

## TABLE OF CONTENTS

CHAPTER	DESCRIPTION	PAGE
<b>1</b>	<b>INTRODUCTION</b>	<b>1</b>
	1.1 Background	1
	1.2 Problem Description	4
	1.3 Objective	4
	1.4 Project Overview and Research Method	5
	1.5 Outline of Report	6
<b>2</b>	<b>LITERATURE REVIEW</b>	<b>7</b>
	2.1 Introduction	7
	2.2 General Properties of Ferroelectrics	9
	2.2.1 Crystallographic considerations of ferroelectrics	9
	2.2.2 Spontaneous polarizations	11
	2.3 Ferroelectrics Materials	15
	2.3.1 Barium Titanate	16
	2.3.2 Lead Zirconate Titanate	18
	2.4 Thin Film Fabrication Technology	19

# CHAPTER 1

## INTRODUCTION

### 1.1 Background

Human lifestyle has been changing with the changes of the technology. Now, the demand for more comfortable life will be fulfilled with the dependency to electrical and electronics appliances. With the rapid changes of the information technology and all other supporting technology, the life of a human is controlled by electrical and electronic appliances. Start from the moment the eyes are open to the sound of the mobile phone timer, brushing teeth with battery-operated electrical toothbrush, turn on the water heater to take bath; set the microwave timer to heat up breakfast; we will keep on depending on the electrical appliances to do our task, until we are back in our bed, snoozing off and leaving the television with the turn-off timer on.

The scenario in electronics appliances in general can be given as below:

- come in very small parts, and the number of parts are large
- composed of multi elements with large amount of ultra small parts
- use various kinds of complicated materials