

**THE EFFECT OF CONCENTRATION TO THE CRYSTALLINITY  
AND FERROELECTRIC OF THIN PVDF-TrFE (72/28) FILM**

**MOHD SYAMSUL REDZUAN B BASIRUN**

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## ABSTRACT

### THE EFFECT OF CONCENTRATION TO THE CRYSTALLINITY AND FERROELECTRIC OF THIN PVDF-TrFE (72/28) FILM

PVDF-TrFE is a ferroelectric copolymer with a strong piezoelectric effect, and is widely used in broad range of applications in electronic and micromechanical system. In many of these applications such as data storage and memory devices, the thickness of the polymer films were reduced so as to reduce operation voltage. However the thickness of the film is limited by the ferroelectric response. In this study, different concentration of PVDF-TrFE (72/28) of 0.25g/ml, 0.20g/ml, 0.15g/ml, 0.10g/ml and 0.05g/ml were used. The thin films were spin coated and was annealed with a hot plate at temperature  $(160 \pm 1)$  °C. The film thickness was determined using a Field Emission Scanning Electron Microscopy (FESEM). The crystal form was characterized using Polarized Light Optical Microscopy (PLOM), Field Emission Scanning Electron Microscopy (FESEM) and Fourier Transform Infrared (FTIR). The solution concentration of 0.25g/ml produces thicker PVDF-TrFE (72/28) copolymer film whilst the spinning parameter had insignificant contribution to the thickness of the film. The PVDF-TrFE (72/28) copolymer film showed an increase in the amount of crystal and crystal size at 0.25g/ml. The orientation of crystal of the film was found to be scatter and there was no alignment of crystal.

## CHAPTER 1

### INTRODUCTION

#### 1.1 Overview

PVDF – TrFE thin film is a ferroelectric copolymer that having a strong piezoelectric effect, and is widely applied in broad range of applications in electronic and micromechanical system. In many of these applications such as data storage and memory devices, the thickness of the PVDF – TrFE thin film is very critical. The thin film should be kept as thin as possible so that the operation voltage can be low and also decreasing the cost. But the thickness should be controlled so that the ferroelectric response remains relatively high. On the other hand, as the polymer film thickness is reduced, many experimental results have shown that changes in polymer properties will occur when the film dimension approaches one of the intrinsic dimensions of the polymer. Hence, for PVDF – TrFE thin film, how to minimize the influence of those changes on the ferroelectric response as the thickness is reduced is crucial for many applications. PVDF – TrFE is one of the most important ferroelectric polymers and as typical semicrystalline polymer, it is well known that the ferroelectric response are mainly from the crystalline phase. This ferroelectric phase occurs in the bulk