

**ELECTRICAL PROPERTIES OF METAL-INSULATOR-SEMICONDUCTOR  
(MIS) USING LOW TEMPERATURE DEPOSITION OF ZnO AS  
SEMICONDUCTOR LAYER**

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## ABSTRACT

This paper investigates the performance of low temperature zinc oxide (ZnO) film as semiconductor and poly(methyl methacrylate) (PMMA) as insulator layer in metal-insulator-semiconductor (MIS) structure. ZnO semiconductor films were grown at different temperatures from 40°C, 60°C, 80°C, 100°C and 120°C. X-ray diffraction (XRD) result revealed that ZnO film grown at 120°C has (002) crystal structure with better crystallinity compared to the other temperatures. Field emission scanning electron microscopy (FESEM) image also show structure transformation of ZnO grain from rice shape to round shape at 120°C. ZnO grown at 120°C show the best electrical properties to be applied as semiconductor layer in MIS devices. The conductivity of MIS increased as the ZnO temperature were increased as deposition temperature increased. The leakage current density for MIS device show that the value increased from  $2.0 \times 10^{-11}$  A/cm<sup>2</sup> to  $4.38 \times 10^{-10}$  A/cm<sup>2</sup> as the temperature of ZnO increased. Dielectric properties of MIS indicates that MIS with ZnO grown at 120°C has the highest dielectric constant,  $k \sim 7.7$  measured at 1 kHz. The best characteristics of MIS obtained from the structure with ZnO grown at 120°C due to high conductivity, high crytallinity, good surface morphology and high  $k$  value.

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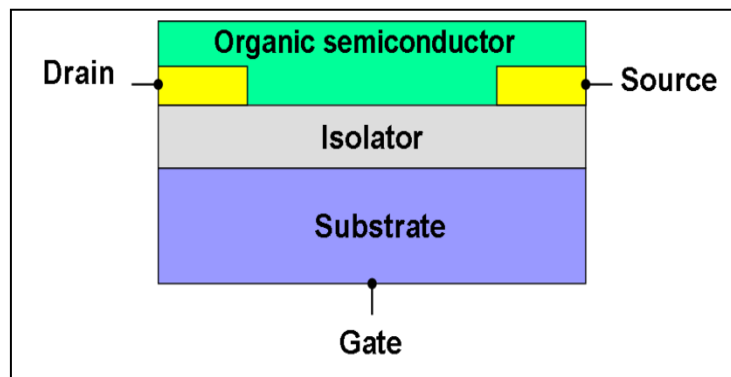
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# CHAPTER 1

## INTRODUCTION

### 1.1 PROJECT OVERVIEW

Organic Field Effect Transistor (OFET) is a transistor using an organic material in its structure. Basically in OFET, the organic material is used as semiconductor layer and the material used are such as pentacene, rubrene, tetracene and many others. This device has been developed to realize low-cost, large-area electronic products and biodegradable electronics. The operation and structure of OFET are similar to thin-film transistor (TFT). The performance of OFET depends on the properties of the semiconductor and dielectric layer such as surface morphology and thickness. It is directly have effect on the carrier mobility of the device.



**Figure 1. 1. OFET structure**