EFFECT OF DIELECTRIC LAYER THICKNESS ON THE ELECTRICAL PROPERTIES OF MIS DEVICES

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AHMAD SYAUQI BIN MOHD NOR (2010294544)
Faculty of Electrical Engineering
Universiti Teknologi MARA
40450 Shah Alam, Malaysia

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ABSTRACT

This research investigated the effect of dielectric thickness to the electrical properties metal-insulator-semiconductor (MIS) device. The MIS device were fabricated having PMMA:TiO_2 and ZnO as dielectric and semiconductor layer, respectively. The PMMA:TiO_2 nancomposite dielectric film were deposited at different deposition speed from 1000, 2000, 3000, 4000, 5000, and 6000 rpm. Results showed that there is difference in the nanocomposite dielectric film thickness when varying the deposition speed. As the spin speed increased, the thickness of the nanocomposite dielectric layer was reduced from 995.52 to 383.68 nm. For current-voltage (*I-V*) measurement, PMMA:TiO_2 nanocomposite thin film showed an ohmic behavior meanwhile rectifying behavior for MIS devices. PMMA:TiO_2 nanocomposite thin film give low current compared to MIS devices with current value approximately in range of 10^{-9} and 10^{-5} ampere respectively. As the PMMA:TiO_2 nanocomposite thin film thickness decrease, the current increased from 2.155 x 10^{-9} to 2.906 x 10^{-9} ampere measured at 5V. The performance of MIS devices is degraded when thickness of the PMMA:TiO_2 nanocomposite dielectric layer is decreased. The AFM image was observed to have an agglomeration of particles on the nanocomposite dielectric films. Roughness increased from 11.62 to 22.00 nm when spin speed are increased.

TABLE OF CONTENT

CHAPTER 1

INTRODUCTION

1.1 BACKGROUND STUDY

Organic Field effect transistor (OFET) is a field-effect-transistor that using an organic materials in its structure. OFET are three terminal devices consist of gate, source and drain electrodes as shown in figure 1.1. In OFET, a semiconductor layer is deposited to bridge the source and drain electrodes. An insulator layer is deposited to space the gate electrode and semiconductor layer. This device has been developed widely today because of its compatibility for low cost, low temperature fabrication process which is favorable for state-of-art electronic devices using flexible substrate. The OFET performance depends on the semiconductor and dielectric layer properties such as morphology and thickness [1].

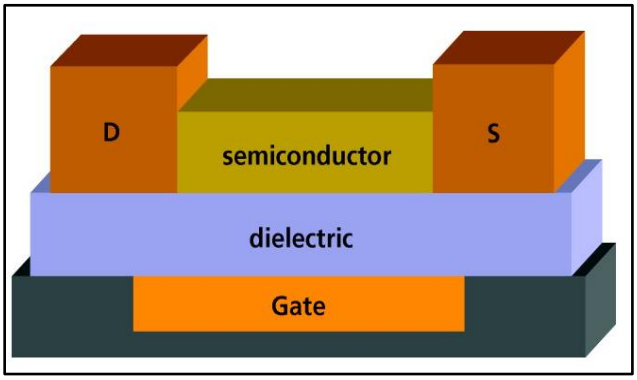

Figure 1.1: OFET structure