THE EFFECT OF OXIDE THICKNESS ON C-V CHARACTERISTICS FOR NMOS

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ABSTRACT

Abstract - This paper is study on the effect of oxide thickness (t_{ox}) on C-V characteristics for NMOS. The project is being done by using SILVACO TCAD software of using ATHENA and ATLAS simulator in order to fabricate the NMOS, extract oxide thickness and see the effect to C-V characteristics. The parameter of gate oxidation such as temperature, HCl and time are being used in order to get the suitable t_{ox} to see the effect to C-V curve. Here, t_{ox} of 10.13nm at time = 11 minutes, and t_{ox} of 10.42nm at time 50 minutes with both HCl = 3% and temperature of 900^{o}C being used for C-V graph .The effect to C'_{ox} will be decreased by 12.3% when t_{ox} is 10.42nm. The low frequency and high frequency is shown in C-V characteristics. As expected, the t_{ox} of 10.13nm produced high capacitance. The defect also can been seen by these C-V curve. In this paper, it shown that there no defects in the C-V characteristics graph and the suitable t_{ox} to be used for NMOS.

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CHAPTER 1
INTRODUCTION

1.1 OVERVIEW

The metal–oxide–semiconductor field-effect transistor or known as MOSFET is the most used semiconductor device today [1]. The basic principle of the device was first proposed by Julius Edgar Lilienfeld in 1925. It is by far the most common field-effect transistor in both digital and analog circuits. With high yield, low cost and dense packaging are considerations that have pushed the MOSFET to the status of the most widely used deviced in information technology hardware. The MOSFET is a device used to amplify or switch electronic signals with fast switching time and most important device for very large scale integrated (VLSI) circuits such as microprocessors [2]. With demand increased for mobile communication and computation, power consumption is a great value to be considered, the MOSFET has become increasingly critical used since it consumes little power [3].

The MOSFET is composed of a channel of n-type or p-type semiconductor material such as silicon,germinium and etc, and is accordingly called an NMOSFET or a PMOSFET and also commonly called as nMOS and pMOS. There are three terminal such as source (S), drain (D) and gate (G). The top layer of the MOS system is the metal , and it is used to form the gate electrode. Central to the functionality is the thin insulating layer, the gate-oxide. Gate oxide layer or known as dielectric is to provide an isolation layer between metal and semiconductor so that there is no current flow between gate and substrate of the semiconductor as shown in Figure 1.1 [1][3].