2D MESH GRID EFFECT OF SILVACO TCAD TOOLS FOR NMOS STRUCTURE

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ABSTRACT

Process of developing the NMOS structure is performed in 2D SILVACO Athena and Atlas Simulation tools. Mesh grid effects are obtained by varying the grid in x-axis and y-axis. Simulation results compared will have the same parameters in its doping concentration, same time and temperature during wet oxidation and go through the same geometrical etching process. Simulation results show that mesh grid has major effect on net doping and wet oxidation process in NMOS structure. Doping concentration will affect junction depth formation due to mesh grid where the difference of net doping can be seen at the surface of the substrate. Change in junction depth formation will then gave an effect to the value of threshold voltage. Observation using sheet resistance of Athena tool shows that having high density mesh in y-axis will results in high concentration at the highly doped region (n++) but low concentration in the lightly doped region (LDD). Effect due to x-axis variation occurs during wet oxidation process while variations in y-axis affect the ion implantation process. Geometrical etching process was also being investigated but shows that mesh grid has no effect on it. It is not necessary to have fine mesh for better process simulation results. By focusing on important processes, less time use to complete simulation.

ACKNOWLEDGMENT

CHAPTER 1: INTRODUCTION

CHAPTER 2: LITERATURE REVIEW

CHAPTER 1

INTRODUCTION

1.1   Introduction

This project is base on the SILVACO TCAD tools. TCAD here mean Technology Computer Aided Design. It is the special techniques and programs to automate the process of technology development. It also base on the basic concept of silicon device processing and the basic operation of metal-oxide-semiconductor field-effect transistor (MOSFET).

Constructing the NMOS on SILVACO TCAD tools using high density of mesh grid will gave better process simulation results, but it will need a lot of time to complete all the simulation processes. This study helps to identify the important area of mesh grid according to the process simulation that happens on that particular area of simulation grid. Some processes do not need a fine mesh in order to produce good simulation results, the time to complete all the simulation processes can be reduce by reducing the mesh grid density on these areas.

Mesh grid is the first parameter needs to be initialized in using SILVACO to simulate the NMOS structure. Mesh grid parameter could give effects to the simulation process of NMOS. As an example, doping process depends on the y-axis grid location and spacing. In SILVACO TCAD, mesh grid is also known as the simulation grid. The correct specification of grid is critical in process simulation. The number of nodes in the grid has a direct influence on simulation accuracy and time. A finer grid should exist in those areas of the simulation structure where ion implantation will occur, where p-n junction will formed or where optical illumination will change photoactive component