COMPARATIVE STUDY FOR THREE DIFFERENT STRUCTURES OF THE P-N JUNCTION ON SILICON (111) WAFER.

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Finally, I hope that this report will give the readers some insight to the process of p-n junction fabrication and the best structure to fabricate it.

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Abstract

This project is about a comparative study for 3 different structures of the p-n junction on Silicon (111) wafer. A study about p-n junction was important since it serves as a basis on understanding other semiconductor devices that play a major role on modern technology development nowadays. P-N junction was actually formed by locating the p-type and n-type semiconductors together. And to achieve this, a process called doping was used. Doping is a process which introduces impurities into an intrinsic semiconductor to change its electrical characteristic either by ion implantation, diffusion of dopant, or epitaxy techniques. But in this project, it would be only concentrated on diffusion of dopant since it is the most convenient way. While for the locating the p-type and n-type semiconductors together, there were actually several possible arrangements or structures of locating the p-type and n-type. Based on that idea, this project will investigates the electrical characteristics of each type of the three structures that had been planned to fabricated, the differences, and most ideal structure to fabricate a p-n junction. Method that will be used in fabricating the p-n junction is the same as the basic method in fabricating a p-n junction process except for the lithography process since there will be three different structures of the p-n junction that will be going to be fabricated. Thus the mask used will be different from each structure. And as for the result, it will be obtained by current-voltage (I-V) measurement. From that data, electrical characteristic for each structure, the differences and the most ideal design structures for making a p-n junction can be concluded. After the project had been completed, it shows that structure 3 with large dimension (sample 6) was the best structure for p-n junction fabrication.

CHAPTER 1

INTRODUCTION

1.1 Introduction

Terms of 'semi' means half, while 'conductor' refers to a material or device that conducts or transmits heat or electricity, especially, when regarded in terms of its capacity to do this[1]. Both terms, if combined will give one general meaning of 'semiconductor', which is; a material that has about half of the ability to conducts or transmits electricity. On the other hand, if a material does not have the ability to conducts or transmits electricity it will be called as an insulator. But since the semiconductor material has only half of the ability of a conductor, semiconductor can also be categorized as an insulator. Based on these ideas, a rough conclusion can be made, which is, semiconductor is a material that have both characteristic of conductor and insulator.

Scientifically, semiconductor is a material that has an electrical conductivity due to electron flow which is intermediate in magnitude between a conductor and an insulator. The reason why this kind of material does have both characteristic is that their crystal lattice is modified by introducing impurities or known as dopant into the crystal lattice[2]. This process is called doping. A pure semiconductor before introducing an impurity is called 'intrinsic semiconductor' while semiconductor that had been introduced with impurity is called 'extrinsic semiconductor' [3]. Interesting factrelated to the semiconductor and the doping technique is, the magnitude of the conductivityand the electrical characteristicof the semiconductor material can be altered by controlling the amount of dopant that is going to be introduced into the crystal lattice.After the amount has been decided, semiconductor devices such as diode, transistor, sensor, etc can be fabricated.