EFFECT OF ANNEALING TEMPERATURE AND TIME ON BORON AND PHOSPHORUS SPIN-ON DOPANT IN N-TYPE SILICON WAFER

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ABSTRACT

EFFECT OF ANNEALING TEMPERATURE AND TIME ON BORON AND PHOSPHORUS SPIN-ON DOPANT IN N-TYPE SILICON WAFER

In this study, N-type silicon wafer is doped with Boron dopant and Phosphorus dopant. Both of doping process is using spin-on dopant. The effect of annealing temperature and time is studied between Boron-doped silicon wafer with Phosphorus-doped silicon wafer. The annealing time will be fixed at 60 minutes when the annealing temperature is varied at 750°C, 850°C, 950°C and also 1050°C. The same applies when the annealing temperature is fixed at 900°C, the time is varied at 60 minutes, 75 minutes, 90 minutes and also 105 minutes. Other parameters that had been fixed is spin-coat speed and time; at 1300 rpm for 20 seconds and also volume of dopant; 1.3 ml in order to compare the sheet resistivity base on variables of annealing times and temperature only. After annealing process via diffusion module, the sheet resistivity will be measured using four point probe. Many points of testing were taken from each wafer for more accuracy. Data of sheet resistivity versus number of points is plotted into graphs and had been compared between dopant of Boron and Phosphorus and also different times of annealing and different temperatures of annealing. Phosphorus dopant on N-type silicon wafer had shown more reliable conductivity rather than Boron dopant on N-type silicon. Resistivity of Boron dopant on N-type shows high sensitivity from time of annealing and result in unpredictable resistivity.

CHAPTER 1 INTRODUCTION

1.1 Background

Spin on dopant is a process to spin on liquid dopant onto the silicon wafer surface. In this proposal, p-type spin on dopant and n-type spin on dopant will be used onto the n-type silicon wafer. To spin the dopant on the silicon wafer surface, a spin coater is used. With a certain value of high speed rotation rate, the dopant is spread all over the silicon wafer. Then, the diffusion process will take place. In the dopant, there are impurity atoms that will be diffused onto the silicon layer. The diffusion process is one of a high temperature process. Thus, it is done in a carefully controlled-temperature furnace. Doping is the most important process in the semiconductor devices fabrication process as doping will introduce majority charge carriers for the devices to function. Without doping process, the device will not work. The challenge in this investigation is to obtain best conductivity values of dopant layer within the wafer and also from one wafer to another wafer by using spin-on dopant and other normal tools.