ELECTRICAL EFFECT OF POROUS SILICON DOPED WITH ERBIUM

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Lastly, I hope my project will help me to obtain knowledge and exposure in the field of science and technology as well as to introduce some basic techniques and tools that can be used in the future.

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ABSTRACT

ELECTRICAL EFFECT OF POROUS SILICON DOPED WITH ERBIUM

Porous Silicon (PSi) is a form of the chemical element silicon which has an introduced nanoporous holes in its microstructure. In its natural state, it is highly resistive, insulative and its open structure allows doping foreign element/elements into porous silicon. Porous Silicon (PSi) was prepared by electrochemical etching using p-type Si wafer substrate with constant current density, 20mA/cm^2. Ethanoic hydrofluoric acid (HF) 48% electrolyte and ethanol (C_2H_5OH) at ratio 1:1 electrolyte was used. Then, the samples was doping with Erbium(III) nitrate pentahydrate($Er_3NO_3OH_5$) by using immersion vibrating technique. Porous silicon doped with $Er_3NO_3OH_5$ was coated with gold by using sputtering technique to make a metal contact. Finally, samples were tested by using IV testing.

The result shows that when the $Er_3NO_3OH_5$ is diffused into porous silicon, only 0.05g of $Er_3NO_3OH_5$ able to diffuse into the pores and the others sample, erbium had been gathered on the surface of the sample. The resistance of porous silicon (PSi) is increased drastically when the mass of erbium increase. The mass of $Er_3NO_3OH_5$ increase the conductivity values of porous silicon doped with $ErNO_3$.

CHAPTER 1

INTRODUCTION

1.0 Introduction

Porous silicon (PSi) have provided important applications to science and industry. Porous silicon was first discovered by Uhlir in 1956 and for almost 50 years and after 1990 the interest about porous silicon grew significantly. In the 1990s, Leigh Canham was published his results on red-luminescence from porous silicon, that was explained in terms of quantum confinement of carriers in nano-crytals of silicon which are present in the pore walls. Since that time, the interest of researchers and technologists to this material and other porous semiconductors as well is constantly growing and the number of publications dedicated to this class of material increases every year. With the discovery of efficient visible light emission from porous silicon came an explosion of work focused on creating silicon-based optoelectronic switches, displays and lasers.

Porous Silicon (PSi) is a form of the chemical element silicon which has an introduced nanoporous holes in its microstructure, rendering a large surface to volume ratio in the order of $500m^2/cm^3$. Silicon is widely used in semiconductors because it remains a semiconductor at higher temperatures than the semiconductor germanium and because its native oxide is easily grown in a furnace and forms a better semiconductor/dielectric interface than any other material.