FABRICATION OF POROUS SILICON NANOSTUCTURES CHEMICAL SENSOR

MOHD HUSAIRI BIN FADZILAH SUHAIMI

Final Year Project Report Submitted in
Partial Fulfillment of the Requirements for the
Degree of Bachelor of Science (Hons.) Industrial Physics
in the Faculty of Applied Science
Universiti Teknologi MARA

NOVEMBER 2010

ACKNOWLEDGEMENT

Assalamualaikum w.b.t,

Firstly, I would like to express our grateful to ALLAH S.W.T for giving me the mercy and good health to finish my proposal as the way it has to be. I also would like to thank to my most helpful and respected supervisor, Prof. Dr. Saifollah bin Abdullah, my Co-supervisor, Mr. Azlan and Assoc. Prof. Dr. Mohamad Rusop bin Mahmood and my lecturer Miss Farah Liyana who had given a lot of co-operation and favor to guide me along the process in completing this project. Besides, not forget to my family who had given me a lot of support and encouragement. To other members Nurul Hadi, Hafizah and Syakira, thank you for their co-operation with successful result. For those people around us who gives information and advice that related to our project. A lot of thanks to them. Lab assistant, Mr. Abdul Katab, a lot of thanks to him.

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.

ABSTRACT

FABRICATION OF POROUS SILICON NANOSTRUCTURES CHEMICAL SENSOR

Porous Silicon Nanostructures (PSiN) was prepared by electrochemical etching using p-type Si wafer substrate with constant current density, 20 mA/cm^2. Ethanoic hydrofluoric acid (HF) 48% electrolyte and ethanol (C_2H_5OH) at ratio 1:1 electrolyte was used. The sample was characterized by using Photoluminescence (PL) spectrum. Porous silicon nanostructures (PSiN) chemical sensor was fabricated by using sputtering technique (gold) to prepare metal contact. This metal was being prepared on the samples as an electrode of sensor and increase sensitivity of sensor. Finally, sample was tested with potassium phosphate (K_2HO_4) at different concentration under *I-V* system.

The result shows that when the potassium phosphate diffuses into a pore, the resistance of porous silicon nanostructures (PSiN) was decreased drastically at about 81.82%. It was also found that the resistance became stable at certain point after solution dropped. Resistance (average) of PSiN decrease with increase of chemical solution concentration dropped. So it concluded that the porous silicon nanostructures sensor is able to detecting the chemical solution.

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CHAPTER 1

INTRODUCTION

1.0 Introduction

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. Fabrication of porous silicon may range from its initial formation through stain-etching or anodization cell, drying and storage of porous silicon and surface modification needed. In this project, porous silicon is produced by electrochemical dissolution of crystalline silicon in a HF based electrolyte. The amount of material etched from the substrate surface can range from 20 to 90% and layer characterized by a wide range of porosity are obtained.

The resulting structure consists of pores alternating with crystalline silicon rods attached to a crystalline silicon substrate. Large internal surface areas of pores are sensitive to the presence of charged molecules, which can be exploited for sensor development. The physical layer structure of the porous sensors has been