THE STUDY OF ELECTRICAL PROPERTIES OF POROUS SILICON NANOSTRUCTURE

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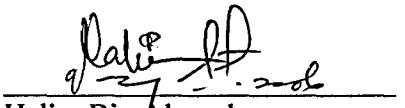

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ABSTRACT

"The Study of Electrical Properties of Porous Silicon Nanostructure"

Porous Silicon (PSi) nanostructure have been formed by anodically etching polished p-type [100] CZ silicon wafer with 4-8 ohm resistivity in a 1:1 ratio of Hydrofluoric and Ethanol solution. The effect of varied time of preparation parameters of PSi on its electrical properties, optical properties and chemical properties was determined from the Current-Voltage characterization, Photoluminescence spectroscopy and Fourier transform infrared spectroscopy (FTIR). The as prepared sample was determined its optical properties and chemical properties. After that it will make into a diode like structure to determine its electrical properties. The results show that the photoluminescence of the PSi shift to shorter wavelength as the preparation parameters is optimized. The resistance and resistivity of the PSi also shows better results as expected by the theory when increasing the time of etching. The importance of understanding the role of preparation parameters of Porous Silicon is significant in accordance to obtain better results in future fabricating semiconductor devices.

CHAPTER 1

INTRODUCTION

Silicon is a well known material in microelectronics. Microelectronics is probably the most important achievement of our time, comparable with the invention of letterpress in the 16th, the invention of steam engine in the 18th century, respectively. If nowadays one is talking about "scientific revolution", the term microelectronic is inevitable. The technologies associated with the head words "Internet" and "Data Highway" wouldn't be conceivable without the invention of the transistor. Although the first transistor was realized with germanium, today's microelectronics technology is dominated by exclusively one material known as Silicon. Silicon is a chemical element present in sand and glass at room temperature the band gap of silicon is 1.12 eV, corresponding to 1.14 μm wavelength of light emission. Unfortunately, Silicon has an indirect band gap, its efficiency of light emission is too small to use practically in optoelectronic devices. In fact, some materials have better properties, for instance, gallium arsenide (GaAs), but there are many reasons why silicon is the material of choice.

PSi formation is the result of an electrochemical etching process where silicon is selectively removed from the bulk material. Although PSi was discovered by Uhlir in 1956 and Turner. The more noticeable interest shown from the start of this decade came with the demonstration by Canham (L.T Canham et al., 1990). The properties of silicon structures are of increasing importance for a fundamental understanding of nano system