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INVESTIGATION OF DELAY TIME IN INTERGRATED PULSED ELECTROCHEMICAL ETCHING OF POROUS SILICON FOR POTENTIAL OPTOELECTRONIC APPLICATION

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BACHELOR OF ENGINEERING (HONS) ELECTRICAL AND ELECTRONIC ENGINEERING

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the results of my own work, unless otherwise indicated or acknowledged as referenced work.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Porous silicon was fabricated using Integrated Pulsed Electrochemical Etching (IPEC) and its structural, optical properties and electrical properties were being analysed. The IPEC technique is actually the combination of electroless etching and electrochemical etching method. In this research, silicon n(100) was being used. Introduction of delay time in IPEC technique is predicted to enhance the uniformity of the pore structure obtained, higher porosity uniform and stability improved. In the IPEC, delay time (T_D) = 0 min, 3 min and 5min were being applied with current density, J= 10mA/cm2 and etching time of 30 minutes. The clock cycle is 14ms where T_{ON}= 10ms and T_{OFF}= 4ms. By applying the delay time, an electroless etching process is being carried out. The results obtain indicated that by applying delay time, it helps to enhance the density of the pores and also uniformity of the porous structures. AFM analysis indicated that when dissolution of Si occurred, the roughness of Si increases. HR-XRD shows that higher peak intensity and no peak shift indicating better crystallites and homogenous pore structures with absence of stress. A broad visible photoluminescence (PL) peak at range 647 nm to 650nm in orange red region with blue shift is observed. The large broadening and shifting of PL peaks towards higher energy is observed which indicated the occurrence of quantum confinement effect in the nanosized particle of crystalline Si. The increase of the bandgap happens with a decrease in the crystallite size of the PS. From the IV characterisation, Ni contact has been made onto the PS samples, the dark current, I_{dark} is decreased thus the value of the photocurrent, I_{photo} has increased in the Ni MSM photodetector.

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