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THE ELECTRCAL AND OPTICAL CHARACTERIZATION OF POROUS GAN FOR PHOTODETECTOR DEVICE APPLICATION

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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

Gallium Nitride (GaN) is a material that is widely used in a variety of applications, including photodetectors, due to its unique features. However, a major difficulty encountered in these applications is the devices' poor sensitivity and light absorption capacity. The invention of MSM photodetector based porous GaN (PGaN) overcame this issue by providing a substantially bigger surface area within the material. The larger surface area improves the interaction of the material with light, increasing the device's sensitivity and overall performance. This paper is to investigate the effect of different etching time during the Photoelectrochemical etching at low temperature (45,60, and 90min) and room temperature of 60min technique on the properties of PGaN using Field Emission Scanning Electron Microscopy (FESEM), Atomic Force Microscopy (AFM), X-Ray Diffraction Ray – Rocking Curve (XRD-RC), and Photoluminescence (PL) and to investigate and compare the performance of as-grown and PGaN based photodetectors in on I-V characteristics which are sensitivity, current gain, response time and recovery time. This was done by fabricated Metal-Semiconductor-Metal (MSM) photodetector based as-grown and PGaN by depositing Pt contact on GaN film. The findings reveal that, sample of 60min under low temperature have the highest value of current gain which is 2.759 under UV illumination and 1.812 under visible light. The sensitivity of 60min under low temperature achieved the highest percentage sensitivity of 175.92% under UV illumination and 87.87% under visible light. In time response, 60 min under low temperature gained the fastest response and recovery time with 1.236s and 1.441s. This showed that PGaN under 60min etching time of low temperature is the suitable for high performance photodetector compared to the other samples.

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