

**UNIVERSITI TEKNOLOGI MARA  
CAWANGAN PULAU PINANG**

**ENHANCING THE  
PERFORMANCE  
OF SOLAR CELL  
BY USING DIFFERENT  
LAYER OF  
ANTI-REFLECTIVE COATING**

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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

The rising of renewable energy is booming its way to our country's power generation field. This is because of the ample sunshine throughout the year, which makes it very appealing for the development of solar energy. However, reflectivity causes solar cell to lose potential photons to be confined. Hence, the aim of this work is to enhance the performance of solar cell by using different layer of anti-reflective coating. In this work, Gallium Arsenide was used as the solar cell substrate as it produces a better outcome compared to a Silicon solar cell. Materials such as  $\text{SiO}_2$ ,  $\text{Si}_3\text{N}_4$  and  $\text{SiO}_2/\text{Si}_3\text{N}_4$  are used as the layers of anti-reflective coating. By using SILVACO TCAD tool, the solar cell structure was designed and modelled with ATHENA software. Meanwhile, ATLAS was utilized to simulate the electrical and optical properties such as the External Quantum Efficiency (EQE), I-V characteristic and spectral response, which were observed. The planar GaAs solar cell with anti-reflective coating of  $\text{SiO}_2$ ,  $\text{Si}_3\text{N}_4$  and  $\text{SiO}_2/\text{Si}_3\text{N}_4$  showed efficiency at 9.38%, 10.88% and 10.68%, respectively. For porous structure,  $\text{SiO}_2$ ,  $\text{Si}_3\text{N}_4$  and  $\text{SiO}_2/\text{Si}_3\text{N}_4$  layers exhibit 9.32%, 10.75% and 10.31%, respectively in terms of efficiency. In conclusion,  $\text{Si}_3\text{N}_4$  material exhibits excellent efficiency to be used as an anti-reflective coating on GaAs solar cell.

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