NUMERICAL SIMULATION ON THE OPTICAL AND ELECTRICAL PROPERTIES FOR HETEROJUNCTION SOLAR CELL USING AL_2O_3/ITO DOUBLE LAYER ANTI REFLECTIVE COATING

NURUL AINA NABIHAH BINTI HAMDAN
(2019295292)

Final Year Project Report Submitted in
Partial Fullfilment of the Requirement for the
Degree of Bachelor of Science (Hons.) Physics
in the Faculty of Applied Sciences
Universiti Teknologi MARA

AUGUST 2022

This Final Year Project entitled **"Numerical Simulation on the Optical and Electrical Properties for Heterojunction Solar Cell Using Al_2O_3/ITO Double Layer Antireflective Coating"** was submitted by Nurul Aina Nabihah binti Hamdan in partial fulfilment of the requirements for the Degree of Bachelor (Hons.) Physics, in the Faculty of Applied Sciences, and was approved by

Puan Noorsyam Yusof
Supervisor
B. Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

_____

Dr Mohd Zaki Mohd Yusoff
Co-Supervisor
B. Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
40450 Shah Alam
Selangor

_____

Dr Khuzaimah Nazir
Project Coordinator
B. Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

_____

Dr. Zuliahani Ahmad
Head of Programme
B. Sc. (Hons.) Physics
Faculty of Applied Sciences
Universiti Teknologi MARA
02600 Arau
Perlis

Date: _____

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ABSTRACT

NUMERICAL SIMULATION ON THE OPTICAL AND ELECTRICAL PROPERTIES FOR HETEROJUNCTION SOLAR CELL USING AL_2O_3/ITO DOUBLE LAYER ANTI REFLECTIVE COATING

Solar cell has become one of the options to a greener world. Various studies has been done to achieve a solar cell with high efficiency and reasonable in price. To accomplish this study, heterojunction solar cells using Al_2O_3/ITO as the double layer anti-reflection coating are analyzed using the Wafer Ray Tracer simulation by the PV Lighthouse. The light trapping scheme use Al_2O_3 and ITO as the double anti-reflection coating (DLARC) to support the reflection, absorption and transmission (R, A, T) of the silicon solar cell. It acts as to minimises reflectance and improves the overall efficiency of the solar cell. The focus of DLARC variation is to increase absorption while decreasing reflection and transmission. High refractive index of the hydrogenated a-Si (a-Si:H) emitter layer generates excessive reflection losses in SHJ solar cells making the silicon wafer have a low absorption efficiency. The DLARC thickness and base angle are varied as part of the simulation using the Wafer Ray Tracer by PV Lighthouse. The surface morphology of upright pyramid texture, height is 3.536 μm, texture base angle 54.74°, width 5μm are used for reference scheme. Four schemes will be analyzed through out this study along with the reference scheme. The result of this study is, Scheme 3 gives the optimum result with 99% absorption, 21% reflection and 67% transmission. The objective of this study is to analyze the optimum thickness of ARC on optical and electrical properties are then achieved as the thickness and base angle of Scheme 3 varied gives the optimum result. J_{max} value of Scheme 3 is also the highest with 0.3842 mA/cm^2. In conclusion, the Wafer Ray Tracer from PV Lighthouse simulation can identify and analyzes the reflection, absorption and transmission of the silicon solar cell.