# MODELLING AND OPTIMIZATION OF A LIGHT TRAPPING SCHEME IN A SILICON SOLAR CELL USING SILICON NITRIDE (SiNx) ANTI-REFLECTIVE COATING

**ALIAH SYAFIQAH BINTI ZAMBREE**

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## TABLE OF CONTENTS

## LIST OF FIGURES

# ABSTRACT

## MODELLING AND OPTIMIZATION OF A LIGHT TRAPPING SCHEME IN A SILICON SOLAR CELL USING SILICON NITRIDE (SiNx) ANTI-REFLECTIVE COATING

Solar cells system has been gaining remarkable attention in the photovoltaic (PV) industry in recent years. Therefore, many people used solar cells in their life. But, from time to time, many industries keep improve it to get the best of efficiency of the solar cell. In this work, it presents ray tracing of light trapping, (LT) schemes in thin c-Si to enhance broadband light absorption within 300-1200 nm wavelength region. For the ray tracing simulation, mono c-Si wafer with 100 μm thickness is investigated and solar spectrum (AM1.5G) at normal incidence is used. Front planar with silicon nitride (SiNx) anti-reflective coatings (ARC) with the difference thicknesses are the LT schemes being studies in this work. The broadband anti-reflective coating (ARC) can effectively reduce the optical loss and improve the energy efficiency in the solar cells. The optical properties of the thin c-Si are analyzed with incremental LT schemes. Not only that, the current density also calculated from the absorption curve. Optical properties and current density were evaluated to find out the best thickness and refractive index of the silicon nitride (SiNx). The proposed ARC material is silicon nitride (SiNx) but with different thickness which are 75 nm, 80 nm and also 56.78 nm. The initial simulation results show that the solar cell current density is about 24.81 mA/cm$^2$. A great $J_{max}$ enhancement in solar cell was achieved with utilizing the ARC thickness. Among the three ARC thickness, 75 nm SiNx ARC realized a good improvement in $J_{max}$ enhancement which reached about 41.31% when compared to the reference c-Si.