

**INFLUENCE OF DIFFERENT ANTI-REFLECTIVE COATING ON SILICON
SOLAR CELLS IN PVLIGHT HOUSE**

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ABSTRACT

INFLUENCE OF DIFFERENT ANTI-REFLECTIVE COATING OF SILICON SOLAR CELLS IN PVLIGHT HOUSE

Crystalline silicon (c-Si) is the most widely used material in solar cells, however, its high surface reflectance limits light absorption and reduces overall efficiency. To overcome this issue, light trapping (LT) strategies is required to boost light absorption and overall performance. This study investigates several potential anti-reflective coating (ARC) materials, three different ARC thicknesses, and various surface texturing techniques to improve light absorption and enhance the performance of crystalline silicon (c-Si) solar cells through numerical simulation. Ray tracing simulations of LT schemes in c-Si were also conducted across the 300–1200 nm wavelength range. A c-Si wafer with a thickness of 200 μm was used, and the solar spectrum was set to AM1.5G under normal incidence. ZnO is chosen as the best ARC on top of several thickness starting from 75-125 μm . The optimum thickness that results in maximum current density is carry on for further modification on surface texturing. It was shown that ZnO with 75 μm thickness and front random inverted pyramid texture revealed as the best performance with the highest current density of 41.80 mA/cm^2 . This show enhancement of 63.35% compared to c-Si reference scheme with value of 25.59 mA/cm^2 . This significant improvement is due to perfect refractive index of ZnO and optimum thickness that follow quarter wavelength that enhance optical absorption. Additionally, the random inverted pyramid texture increases the optical path length through multiple internal reflections, enhancing light absorption within the silicon layer and improving overall efficiency.

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