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THE EFFECT OF FRONT SURFACE TEXTURES AND SUBSTRATE THICKNESS ON OPTICAL PERFORMANCE SILICON-BASED SOLAR CELLS

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ABSTRACT

THE EFFECT OF FRONT SURFACE TEXTURES AND SUBSTRATE THICKNESS ON OPTICAL PERFORMANCE SILICON-BASED SOLAR CELLS

This study investigates the influence of front surface textures and substrate thickness on optical performance of silicon-based solar cells. The research addressed the need to improve light absorption and minimize reflection losses in photovoltaic technologies. Front surface texturing enhances internal light reflection, while increased substrate thickness contributes to higher optical absorption. This project combines both approaches to optimize solar cell performance. The aim of this study is to determine the effect of three different front surface textures which include planar, upright pyramid, and inverted pyramid, the effect of substrate thickness in the range of 20-600 μm on the optical performance, and the optimum combination of the front surface texture with substrate thickness. The simulation was conducted using PV Lighthouse Wafer Ray Tracer to analyze the pattern of light reflection, absorption, and the photocurrent density to determine the optical performance of solar cell. The results shows that the inverted pyramid texture exhibit the highest optical performance and this performance further improve when combined with the largest substrate thickness of 600 μm.

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