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NNL Abstract V1

Title: Light trapping for >30% tandem solar cells built on c-Si

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Abstract (250 words)

reducecost per Watt will beIn order to achieve efficient tandems solar cells based on such materials, it is important to understand the quantify the effect of the optical design on the device performance.

We present key design parameters for optimising light distribution in these devices using simple analytical models. The parasitic light absorption of two transparent conducting layers is found to require top-cell efficiencies greater than 15% to achieve a break-even tandem efficiency of 25%. Low-pass intermediate reflectors are observed to be detrimental to tandem performance, and single-pass absorption is identified to be preferable to Lambertian light trapping with losses. Clear design principles are outlined to avoid these losses and simple light trapping mechanisms are presented that distribute light effectively across the tandem cell.

We present detailed Figure of Merit calculations for various light trapping mechanisms, outline a broad overview of top cell requirements to reach specific target efficiencies, and identify key design parameters that will enable the field to get there.

Summary (100 words)

Tandem cells based on high-efficiency c-Si solar cells can potentially lead to much higher solar cell efficiencies and lower costs of solar energy. Using simple analytical models we present key design parameters for optimising light distribution in these devices. Low-pass intermediate reflectors are observed to be detrimental to tandem performance, and single-pass absorption is identified to be preferable to Lambertian light trapping with losses. We present detailed Figure of Merit calculations for various light trapping mechanisms, outline a broad overview of top cell requirements to reach specific target efficiencies, and identify key design parameters that will enable the field to get there.