

# HIT-Perovskite Bifacial Tandem to Produce Output Power > 330 W/m<sup>2</sup> (PV-4)



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## Scientific Achievement:

We analyze a novel Si heterojunction-perovskite (HIT-PVK) bifacial tandem cell that uses direct light as well as the albedo. Using state-of-the-art sub-cells, the bifacial tandem yields ~330 W/m<sup>2</sup> (i.e.,  $\eta_T^* \sim 33\%$ ), which is 30% higher compared to a conventional HIT-PVK tandem under standard solar illumination (AM1.5G: 1000 W/m<sup>2</sup>) [1].

## Significance and Impact:

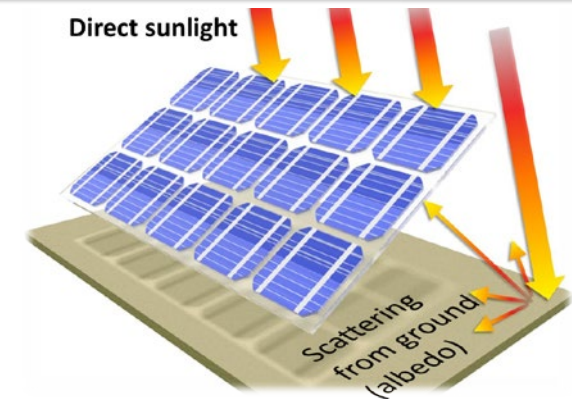
1. The bifacial tandem out-performs both the bifacial HIT and the conventional tandem for practical albedo ( $R_A$ ) of ~ 30%.
2. In the thermodynamic limit, such cells can achieve up to ~520 W/m<sup>2</sup> of output [2], significantly higher than all other comparable cell technologies.
3. The bifacial HIT-PVK tandem is robust to thickness variations when compared to the conventional HIT-PVK tandem.

## Research Details:

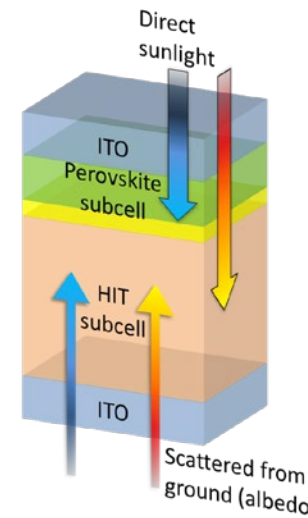
- We performed sophisticated opto-electronic simulations of HIT-PVK bifacial tandem using state-of-the-art HIT and PVK sub-cells [1].
- We explored the physical origin of the performance gain under a variety of albedo reflection, and defined the opportunities and limitations of the technologies.

**Publication(s):** [1] R. Asadpour, R. V. K. Chavali, M. R. Khan, and M. A. Alam, Bifacial Si heterojunction-perovskite organic-inorganic tandem to produce highly efficient ( $\eta_T^* \sim 33\%$ ) solar cell, *APL*, **106**, no. 24, 243902 (Jun. 2015).

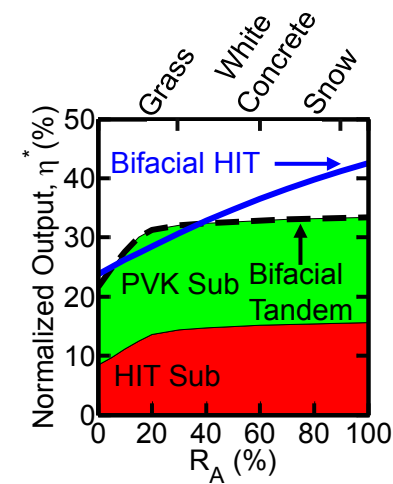
[2] M. R. Khan, and M. A. Alam, Thermodynamic limit if bifacial double-junction tandem solar cells, submitted to *APL*, 2015.



Direct and albedo light on bifacial panel



Bifacial tandem configuration



Normalized output with varying albedo ( $R_A$ ). Bifacial tandem out-performs a bifacial HIT for  $R_A < 0.4$ .

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