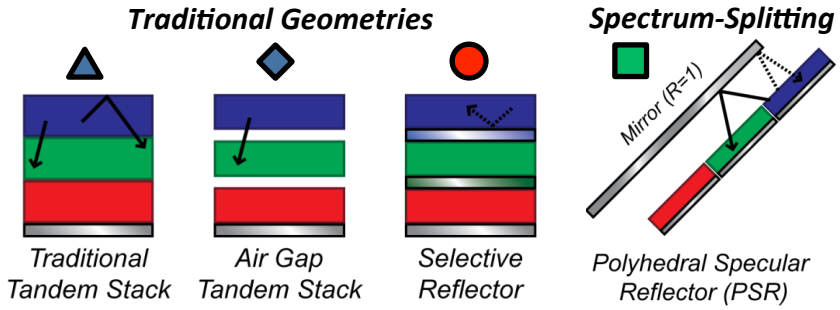
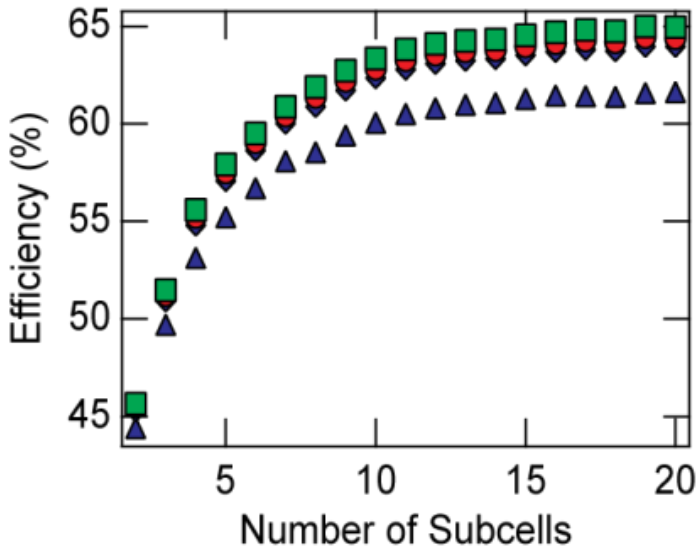
Dec. 2014
Research
Highlight

Higher Maximum Efficiencies for Multijunction Solar Cells Achieved Through Nontraditional Geometries





Multijunction solar cell efficiency as a function of number of subcells for different geometries. Traditional stacked geometries cannot have strong light trapping and radiative coupling, but spectrum-splitting ones (PSR) can and this yields higher efficiencies.

Work was performed at Caltech and Lawrence Berkeley Labs

Scientific Achievement

We have shown that even higher maximum solar cell efficiencies can be achieved by using "spectrum-splitting" geometries that combine strong light trapping *and* radiative coupling.

Significance and Impact

These results redefine the maximum efficiencies possible for solar cell conversion by simply modifying the geometry of the subcells.

Research Details

- Used detailed balance calculations to describe traditional geometries (strong light trapping or radiative coupling) and spectrum-splitting geometries (strong light trapping and radiative coupling)
- Derived and experimentally verified voltage characteristics and power generation at subcell level for certain geometries

C. N. Eisler, Z. R. Abrams, M. T. Sheldon, X. Zhang, and H. A. Atwater. "Multijunction solar cell efficiencies: Effect of spectral window, optical environment, and radiative coupling." *Energy & Environmental Science* **7**, 3600–3605 (2014).

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LIGHT-MATERIAL INTERACTIONS IN ENERGY CONVERSION
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