ADDENDUM

A nanophotonic solar thermophotovoltaic device

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In this Letter, the equation describing T_e^{opt} (see below; and also equation 1.133 in ref. 1) represents the temperature required for the maximum of Planck's distribution expressed in units of wavelength to match the bandgap energy. However, the energy at which the maximum occurs depends on whether we consider energy flux per unit frequency range or per unit wavelength range^{2,3}. A more appropriate approximation matches the maximum of Planck's distribution expressed in units of frequency or energy to the bandgap energy, the scaling factor in this case is 4114 K eV⁻¹.

$$T_e^{\text{opt}} \approx 2336 [\text{K eV}^{-1}] \cdot E_g$$

From the experimental results presented in this Letter, however, it is evident that the peak solar thermophotovoltaic (STPV) efficiency for a 0.55 eV cell is reached at temperatures substantially lower than what the corrected scaling factor suggests. Thus, a match between the bandgap energy and the energy corresponding to the maximum emission does not fully determine the optimal temperature of the emitter, particularly not in the case of STPVs; factors not considered by this simple approximation, such as the thermalization losses in the cell, play a significant role. For a more complete discussion of optimal temperatures in practical STPV converters please refer to ref. 4.

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References

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