

Loss Mechanisms of Thin Film Solar Cells

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The Shockley and Queisser, in their paper published in 1961,¹ discussed theoretical maximum efficiency (the so-called SQ limit) of a single-junction photovoltaic device assuming abrupt change in absorption characteristics across the bandgap and the absence of non-radiative recombination, and predicted efficiency as high as 34% should be achievable. However, record efficiencies demonstrated so far still lag well behind the predicted SQ limit. I will first discuss general reasons behind the performance gap between the SQ limit and actual efficiencies reported. Then I will move onto discussing the proposed loss mechanisms of a specific type of thin film solar cells, namely $\text{Cu}_2\text{ZnSnS}_4$, which has been receiving lots of attention due to its earth-abundance.² Finally I will talk about the implication of high open-circuit voltages (almost reaching the value predicted by the SQ limit) demonstrated from inorganic-organic hybrid perovskite solar cells.

References

1. Shockley and Queisser, J. Appl. Phys., vol. 32, p. 510 (1961).
2. *Copper Zinc Tin Sulfide-Based Thin Film Solar Cells*. Ed. K. Ito, Wiley, 2015