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CZTSSe: Materials and Physics Challenges[1]

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Thin-film photovoltaic (PV) technologies led by CdTe and $Cu(In,Ga)Se_2$ (CIGS) are enjoying growing market share, due to their high performance and cost competitiveness, in the quest for renewable energy for the future. However the reliance on non-earth abundant elements tellurium and indium in these technologies presents a potential obstacle to ultimate terawatt deployment. We recently demonstrated kesterite $Cu_2ZnSn(Se,S)_4$ (CZTSSe) solar cells, comprised of the earth abundant metals copper, zinc and tin, with world record efficiency of 9.7%. In this talk we present a comprehensive device characterization study that pinpoints the key performance bottlenecks in these cells. We find strong buffer-absorber interface recombination and low minority carrier lifetimes that limit the open circuit voltage and a high and diverging device series resistance at lower temperature that suggests a blocking back contact that may limit the fill factor. These findings help to identify key areas for improvement for these CZTSSe cells in the pursuit of a high performance terawatt-scalable PV technology.

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