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Earth abundant materials based on kesterites for photovoltaic applications: Last progresses and perspectives

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One of the most relevant families of next-generation earth-abundant photovoltaic materials is the so-called kesterites ($\text{Cu}_2\text{ZnSn}(\text{S}, \text{Se})_4$ - CZTSSe). This technology has experienced important progress, but at the same time, it is required to overcome urgently the current efficiency limitations to move towards large-scale industrialization. Currently, the record conversion efficiency of kesterites (13.7%, not certified) barely exceeds half of the values reported for $\text{Cu}(\text{In}, \text{Ga})\text{Se}_2$ and CdTe . The main challenge for CZTSSe solar cells is the large V_{oc} deficit, which is remarkably higher in comparison to well established solar cell technologies. In this presentation, the main conversion efficiency limitations of kesterites will be presented, including Cu/Zn disorder, formation and characteristics of deep defects, nature and passivation of grain boundaries and surfaces, secondary phases formation and distribution, band-gap and compositional fluctuations, and origin of tail states. In view of these restraints, advanced technological solutions will be presented including doping and alloying strategies. In particular the positive impact on the properties of CZTSSe of the incorporation of an ultrathin IV element layer on top of the absorber surface that had been recently discovered by IREC. Finally, the perspectives to catch up with the high efficiencies of other thin-film PV technologies will be presented, based in the strategies proposed in the very recently launched European Projects STARCELL (H2020-NMBP-03-2016-720907) and INFINITE-CELL (H2020-MSCA-RISE-2017-777968).

Biography

Edgardo Saucedo obtained his Ph.D. in Materials Physics at the Universidad Autónoma de Madrid, Spain. In 2007, he joined IRDEP (Paris, France), and he has more than three-year postdoctoral experience in France. Currently, he is the Deputy Head of the Solar Energy Materials and Systems Group at IREC (Barcelona, Spain). He holds four patents and has authored more than 175 papers in high impact factor journals. He has an h-index of 29 and more than 3200 citations. He has been involved in more than 25 European and Spanish Projects and is currently the coordinator of the STARCELL (www.starcell.eu) and INFINITE-CELL (www.infinite-cell.eu) H2020 projects. He has supervised 9 Ph.D. Thesis in the thin film photovoltaic field. He has more than 12 years of experience working in the development of thin-film photovoltaic technologies and he is now focused on new advanced material and processes for photovoltaics.

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