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A new paradigm for thin-film solar cells: the case of Earth abundant Cu-N ternary compounds JULIEN VIDAL, XIUWEN ZHANG, STEPHAN LANY, ANDRIY ZAKUTAYEV, DAVID GINLEY, National Renewable Energy Laboratory, Golden, CO, MINGHUI YANG, AMY ALLEN, FRANCK DISALVO, Department of Chemistry, Cornell University, Ithaca, NY — The design of thin film solar cells is extremely sensitive to the choice of the material forming the absorbing layer. Indeed, many of the limitations of solar cell devices are either directly linked to the intrinsic properties of the absorber such as in CdTe or design-related indirect consequences of this choice such as for SnS-based devices. Most of the design of current thin film solar cells rely on chalcogenide materials as the absorbing layer. We propose a new paradigm based on Earth abundant Cu-N ternary compounds as the absorbing layer. We will present the theoretical and experimental investigation of the electronic properties of two Cu-N compounds with interesting photovoltaic properties namely CuSrN and $CuTaN_2$. We performed state-of-the-art defect calculation and GW-based band structure calculations. $CuTaN_2$ was synthesized by ion exchange and its absorption onset was subsequently characterized with diffusive reflectance. While CuSrN displays interesting p-doped capability and defect immunity similar to $Cu(In,Ga)Se_2$, $CuTaN_2$ presents very strong absorption with a sharp absorption onset in the optimal range for photovoltaic conversion. Finally, we will address potential pitfalls of such absorbers related to stability with respect to O_2 and H_2O.

Julien Vidal
EDF R&D, France

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