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## Improvement on conversion efficiency of Cu (In,Ga)Se<sub>2</sub> solar cells by physical modeling

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The use of Zn(O,S) buffer layers in place of CdS with Cu(In,Ga)Se<sub>2</sub> (CIGS) solar cells has been explored. The primary argument for the use of Zn(O,S) is that its higher bandgap, a second reason, the focus of my talk, is that the conduction-band offset (CBO) can be tuned to a more optimal value through modification of the oxygen-to-sulfur ratio. Our calculations show that the target oxygen composition at room temperature based on band-offset considerations alone should decrease from above 90% for CIS to approximately 50% for CGS. The conduction-band offset (CBO) of the Zn (O,S)/window layer heterojunction also can play significant roles in the performance of solar cells. Thin film solar cells with the structure soda lime glass/Mo/Cu(In,Ga)Se<sub>2</sub>/Zn(O,S)/ZnMgO/ZnO:Al are discussed for varying sulfur content of the Zn(O,S) buffer layer and Mg content of ZnMgO. In this talk, some new ideas in material science for improving CIGS cells fabricating in NREL and ZSW would be presented.

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