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Dielectric and Photovoltaic Physics in Thin-Film Crystalline Sulfides[1] RODNEY MCKEE, Oak Ridge National Laboratory, FRED WALKER, Oak Ridge National Laboratory — Solar energy utilization has been the hope and sought-for solution to local energy needs at least since the late 1800's. In today's terms, solar energy is one of the few renewable energy sources with the potential to have a major impact on domestic energy independence. There is a rich, but incomplete scientific literature on the underpinning photovoltaic physics of solar cell development. This literature does however, clearly identify a pervasive, unsolved physics problem – *deep level electronic states in wide band gap semiconductors quench the electro-optic behavior of solar cells: either p-type or n-type doping is inhibited both of which are required for the basic function of a semiconducting p-n junction solar cell.* We will report on our approach towards solving this problem via layer-sequenced stabilization of thin-film photovoltaics that enable symmetric p or n-type doping. We will bring interface phase physics to the synthesis process for sulfur-based chalcogenides to show that the valence and conduction band energy levels as well as defect formation energies in these systems can be systematically modified in wide bandgap photovolatics.

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