Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Relationship Between Absorber Layer Properties and Device Operation Modes For High Efficiency Thin Film Solar Cells RAM RAVICHANDRAN[1], ROBERT KOKENYESI[2], JOHN WAGER[3], DOUGLAS KESZLER[4], Oregon State University, CENTER FOR INVERSE DESIGN TEAM — A thin film solar cell (TFSC) can be differentiated into two distinct operation modes based on the transport mechanism. Current TFSCs predominantly exploit diffusion to extract photogenerated minority carriers. For efficient extraction, the absorber layer requires high carrier mobilities and long minority carrier lifetimes. Materials exhibiting a strong optical absorption onset near the fundamental band gap allows reduction of the absorber layer thickness to significantly less than 1 μm. In such a TFSC, a strong intrinsic electric field drives minority carrier extraction, resulting in drift-based transport. The basic device configuration utilized in this simulation study is a heterojunction TFSC with a p-type absorber layer. The diffusion/drift device operation modes are simulated by varying the thickness and carrier concentration of the absorber layer, and device performance between the two modes is compared. In addition, the relationship between device operation mode and transport properties, including carrier mobility and minority carrier lifetime are explored. Finally, candidate absorber materials that enable the advantages of a drift-based TFSC developed within the Center for Inverse Design are presented.

[1]School of Electrical Engineering and Computer Science
[2]Department of Chemistry
[3]School of Electrical Engineering and Computer Science
[4]Department of Chemistry

Ram Ravichandran
Oregon State University

Date submitted: 15 Nov 2013 Electronic form version 1.4