Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Sulfide and Oxide-Sulfide Combinatorial Libraries by Co-Sputtering with an Atomic Sulfur Source[1] JOSHUA FORD, Univ of Colorado - Boulder, ADAM WELCH, CHRISTOPHER CASKEY, Colorado School of Mines, BART VAN ZEGHBROECK, Univ of Colorado - Boulder, PHILIP PARILLA, DAVID GINLEY, ANDRIY ZAKUTAYEV, JOHN PERKINS, National Renewable Energy Lab — We report a deposition method with improved control over the sulfur content in thin-films through the addition of a radio frequency (RF) solids atom source (cracker) to a multiple-source sputtering system. Co-sputtering from one or two targets provides a compositional gradient across a 2" substrate. In addition, a temperature gradient orthogonal to the composition gradient is induced. An RF solids cracker is used to provide controllable amounts of activated sulfur during the deposition. The composition gradient, temperature gradient and activated sulfur can be used concurrently to control the composition and phase of the thin films. In proof-of-principle experiments, Cu_2S films have been grown from both Cu and Cu_2O targets as well as $Bi_xO_yS_z$ films with tunable oxygen to sulfur ratios from a Bi_2O_3 target. Further, the independent tuning of anion and cation ratios is demonstrated by the growth of BiCuOS. The successful growth of both sulfide and oxide-sulfide compounds demonstrates the viability of this hybrid approach. Finally, this hybrid deposition approach is likely extendable to phosphides and oxide-phosphides.

[1]This work is supported by U.S. DOE EFRC "Center for Inverse Design"

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Date submitted: 20 Nov 2013 Electronic form version 1.4