Abstract Submitted
for the MAR14 Meeting of
The American Physical Society

Quantitative high-resolution mapping of built-in fields in polycrystalline photovoltaic devices using electron beams: effects of surface band bending and recombination NIKOLAI ZHITENEV, CNST, NIST, HEAYOUNG YOON, Maryland Nanocenter, University of Maryland and CNST, NIST, PAUL HANEY, CNST, NIST — Thin film solar cells are based on polycrystalline materials that are structurally and electronically non-uniform. The power conversion efficiency of these inhomogeneous devices is currently well below theoretical limits. To effectively mitigate the recombination sources and further boost the efficiency in such systems, it is highly desirable to understand how the grain cores (GCs), grain boundaries (GBs), and other local variations of composition affect the overall photoelectronic properties of devices. Electron beam induced current (EBIC) is a powerful technique which directly measures the local collection efficiency of excited charge carriers. To achieve the desired high spatial resolution, the size of the electron-hole bulbs has to be minimized, which, in turn, means that the carriers are created within an immediate proximity of the exposed surface. We systematically examine the surface contribution to EBIC by comparing different solar cell devices varying surface preparation and passivation methods, and by analyzing the injection level-dependence of EBIC. We discuss new approaches to quantify the surface field and recombination including EBIC measurements in thin lamella geometry, beam injection parallel to the surface, and in-situ gating.

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Date submitted: 15 Nov 2013 Electronic form version 1.4