## Abstract Submitted for the MAR13 Meeting of The American Physical Society

Highly Efficient Charge Transfer in Nanocrystalline Si:H<sup>1</sup> REUBEN COLLINS, MATTHEW BERGREN, BRIAN SIMONDS, JEREMY FIELDS, CRAIG TAYLOR, THOMAS FURTAK, Colorado School of Mines, KRISTIN KIRILUK, Abengoa Solar, GUOZHEN YUE, BAOJIE YAN, JEFF YANG, TINING SU, SUBHENDU GUHA, United Solar Ovonic, MATTHEW BEARD, National Renewable Energy Laboratory — We demonstrate that in films of silicon nanocrystals imbedded in a hydrogenated amorphous silicon matrix, carriers generated in the amorphous region are efficiently transported to the nanocrystals prior to thermalization into band tail states of the amorphous phase. This transfer causes electron paramagnetic resonance and photoluminescence signals from the amorphous phase to be rapidly quenched as the volume fraction of Si nanocrystals exceeds about 30 percent. Ultrafast carrier dynamics, probed using time-resolved terahertz spectroscopy (TRTS), confirm rapid transport between phases before complete relaxation. TRTS results are consistent with a model where electrons excited in the amorphous material are first trapped at interface states at the amorphous/nanocrystal boundary prior to being thermally emitted into the crystalline phase. These results, which indicate nanocrystalline Si:H is effectively a type I bulk heterojunction material, help explain the enhanced photo stability of this material compared to amorphous silicon by itself. They also suggest routes to using similar structures to increase the efficiency of thin film silicon solar cells.

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