Abstract Submitted
for the MAR15 Meeting of
The American Physical Society

Nanoscale optimization of quantum dot solar sells YANSHU LI, ANDREI SERGEEV, NIZAMI VAGIDOV, VLADIMIR MITIN, State Univ of NY - Buffalo, KIMBERLY SABLON, Army Research Laboratory, STATE UNIV OF NY - BUFFALO TEAM, ARMY RESEARCH LABORATORY TEAM — Quantum dots (QDs) offer possibilities for nanoscale control of photoelectron processes via engineering the band structure and potential profile. Nanoscale potential profile (potential barriers) and nanoscale band engineering (AlGaAs atomically thin barriers) effectively suppress the photoelectron capture to QDs. QDs also increase conversion efficiency of the above-bandgap photons due to extraction of electrons from QDs via Coulomb interaction with hot electrons that excited by high-energy photons. To study the effects of the band structure engineering and nanoscale potential barriers on the photovoltaic performance we fabricated 3-μm base GaAs devices with various InAs quantum dot media and selective doping. All quantum dot devices show improvement in conversion efficiency compared with the reference cell. Quantum efficiency measurements allow us to associate the spectral characteristics of photoresponse enhancement with nanoscale structure of QD media. The dark current analysis provides valuable information about recombination in QD solar cells. The two-diode model well fit the scope of data and recovers the measured open circuit voltage.

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Date submitted: 13 Nov 2014 Electronic form version 1.4