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Photovoltaic Responses of Solar Cells Based on Lead Selenide Quantum Dots and Conducting Polymers XIAOMEI JIANG, SERGEY LEE, ANVAR ZAKHIDOV, University of Texas at Dallas, Richardson, TX, 75083, RICHARD D. SCHALLER, J.M. PIETRYGA, VICTOR KLIMOV, Chemistry Division, Los Alamos National Laboratory, Los Alamos, NM, 87545 — We report on hybrid solar cells based on nanocomposites of conjugated polymers (polythiophene and polyphenylvinylene derivatives) and IR-sensitive PbSe QDs that have a size-tunable energy gap between 0.3 and 1 eV. Thin film cells show very good diode characteristics and sizable photovoltaic response. The good performance of our devices in both photovoltaic and photodiode regimes indicates quite efficient charge separation between the polymer and QD components. To elucidate the mechanism for charge separation in these composite structures, we analyze conduction and valence-band energy offsets derived from cyclic voltammetry measurements. We find the significant increase of photocurrent due to more efficient charge separation when the surface of the quantum dots was treated with pyridine to remove the surface ligand. The analysis of a spectrally resolved photocurrent measurements reveals some evidence of carrier multiplication-enhanced photocurrent in our devices. Specifically, we observe indications of a rapid increase in the photocurrent at spectral energies in correlation with the size-dependent energy gap of the QD component. The onset of this increase correlates with what is expected for the onset of carrier multiplication in PbSe QDs.

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