Schottky-quantum dot photovoltaics for efficient infrared power conversion

(Figure Presented) The air stability and power conversion efficiency of solution-processed PbS quantum dot solar cells is dramatically improved by the insertion of 0.8 nm LiF between the PbS ...

The increasing demand for sustainable and green energy supply spurred the surging research on high-efficiency, low-cost photovoltaics. Colloidal quantum dot solar cell (CQDSC) is a new type of photovoltaic device using lead chalcogenide quantum dot film as absorber materials. It not only has a potential to break the 33% Shockley-Queisser efficiency ...

Stable solution-processed photovoltaic devices having 3.6% power conversion efficiency in the infrared are reported, and diffusion of electrons and holes over hundreds of nanometers through the PbSe colloidal quantum dot solid is chiefly responsible for the high external quantum efficiencies obtained in this new class of devices.

Planar Schottky photovoltaic devices were prepared from solution-processed PbS nanocrystal quantum dot films with aluminum and indium tin oxide contacts. These devices exhibited up to 4.2% infrared power conversion efficiency, which is a threefold improvement over previous results. Solar power conversion efficiency reached 1.8%.

We report here simple planar, stackable PbS nanocrystal quantum dot photovoltaic devices with infrared power conversion efficiencies up to 4.2%. This represents a threefold improvement over the previous efficiencies obtained in ...

Figure 4.1: Isolated p-type semiconductor and low work function metal (left) brought into contact to form a Schottky barrier (right). Negative fixed charges are shown in the depletion region. EVAC is the vacuum energy, EC and EV are the conduction and valence band edge energies, and W is the depletion region width. -"Schottky-quantum dot photovoltaics for efficient infrared power ...

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Colloidal quantum dots (CQDs) have attracted attention as a next-generation of photovoltaics (PVs) capable of a tunable band gap and low-cost solution process. Understanding and controlling the surface of CQDs lead to the significant development in the performance of CQD PVs. Here we review recent progress in the realization of low-cost, efficient lead ...

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PbS colloidal quantum dot photovoltaic devices in a Schottky architecture have demonstrated an infrared power conversion efficiency of 4.2%. Here, we elucidate the internal mechanisms leading to this efficiency. At relevant intensities, the drift length is 10um for holes and 1um for electrons. Transport within the 150nm wide depletion region is therefore highly efficient.

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We elucidate experimentally a quantitative physical picture of the Schottky barrier formed at the junction between a metallic contact and a semiconducting colloidal quantum dot film. We used a combination of capacitance-voltage and temperature-dependent current-voltage measurements to extract the key parameters of the junction. Three differently processed ...

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Colloidal quantum dots (CQDs) are considered as next-generation semiconductors owing to their tunable optical and electrical properties depending on their particle size and shape. The characteristics of CQDs are mainly governed by their surface chemistry, and the ligand exchange process plays a crucial role in determining their surface states. Worldwide studies toward the ...

Near-infrared PbS quantum dots (QDs) composed of earth-abundant elements 2 have emerged as promising candidates for photovoltaic applications because of a tunable energy bandgap that covers the ...

SOLUTION-PROCESSED SCHOTTKY-QUANTUM DOT PHOTOVOLTAICS FOR EFFICIENT INFRARED POWER CONVERSION by Keith W. Johnston A thesis submitted in conformity with the requirements for the degree of Master of Applied Science Graduate Department of Electrical and Computer Engineering

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Figure 2.4: Absorption spectrum of a batch of colloidal PbS nanocrystals used in this work. The 1st and 2nd excitonic transition absorption peaks are clearly visible. (Nanocrystals were synthesized by Dr. L. Levina). - "Schottky-quantum dot photovoltaics for efficient infrared power conversion"

The resultant depleted-heterojunction solar cells provide a 5.1% AM1.5 power conversion efficiency. The devices employ infrared-bandgap size-effect-tuned PbS CQDs, enabling broadband harvesting of ...

Stable solution-processed photovoltaic devices having 3.6% power conversion efficiency in the infrared are reported, and diffusion of electrons and holes over hundreds of nanometers through the PbSe colloidal quantum dot solid is chiefly responsible for the high external quantum efficiencies obtained in this new class of devices. Half of the sun"s power lies in the infrared. ...

Today, renewable technologies are becoming increasingly important for the world"s energy supply, and are accounting for around 4-6% (mainly including contribution of power capacities of wind 539 gigawatts, or GWs, solar photovoltaics (PVs) 422 GWs and biopower 122 GWs) in today"s energy consumption [1, 2].Among these, solar PVs are anticipated to be the ...

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Solution-processed PbS quantum dot infrared laser with room-temperature tuneable emission in the optical telecommunications window. ... the p-SPLE treated CsPbI3 QD solar cell had an enhanced power conversion efficiency and improved stability. ... Schottky-quantum dot photovoltaics for efficient infrared power conversion. K. Johnston. Physics ...

Self-powered photodetectors based on PbS-quantum-dots/indium Schottky barrier diodes exhibit excellent repeatability and stability at a high frequency, and demonstrate high sensitivity in weak light illumination detection and low noise currents. Here we fabricate self-powered photodetectors based on PbS-quantum-dots/indium Schottky barrier diodes ...

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