EM-P001

Size Control of PbS Colloidal Quantum Dots and Their Application to Photovoltaic Devices

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Quantum dots (QDs) are attracting growing attention for photovoltaic device applications because of their unique electronic, optical and physical properties. Lead sulfide (PbS) QDs are one of the most widely studied materials for the devices and known to have size-tunable properties. In this context, we investigated the relationship between the size of PbS QDs and two synthesizing conditions, a concentration of ligand, oleic acid in this work, and injection temperature. The inverted colloidal quantum dot solar cells based on the heterojunction of n-type zinc oxide layer and p-type PbS QDs were also fabricated. The size of the QDs and cell properties were observed to depend on both the QD synthesizing conditions, and hence the overall efficiency of the cell could vary even though the size of QDs used was same. The QD synthesizing conditions were finally optimized for the maximum cell efficiency.

Keywords: Quantum dots, Lead sulfide, oleic acid, injection temperature, size, inverted solar cells, heterojunction

EM-P002

Photovoltaic Properties of Tandem Structure Consisting of Quantum Dot Solar cell and Small Molecule Organic Solar cell

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Connecting two or more sub-cells is a simple and effective way of improving power conversion efficiency (PCE) of solar cells, and the theoretical efficiency of this tandem cell is known to reach 85~88% of the sum of the sub-cell's efficiencies. There are two ways of connecting sub-cells in the tandem structure, i.e. parallel and series connection. The parallel connection can increase the short circuit current (Jsc) and the series connection can increase the open circuit voltage (Voc). Although various tandem structures have been studied, the full use of incident light and optimization of cell efficiency is still limited. In this work, we designed series tandem solar cells consisting of lead sulfide (PbS) quantum dots/zinc oxide-based QDSC and zinc phthalocyanine (ZnPc)/C60-based small molecule OSCs. It is expected that the loss of the incident light is minimized because the absorption range of the PbS quantum dots and ZnPc is significantly different, and the Voc increases according to the Kirchhoff's law.

Keywords: Tandem,QDSC,OSC