Nanooptics and photonics

Si/ITO heterojunction with CdTe quantum dots for solar cells application

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Scientists investigate intermediate band solar cells with quantum dots actively because they have potential for high conversion efficiency [1-3]. CdTe has a number of attractive features as a photovoltaic material system. The recent efficiency of solar cells based on CdTe was around 21% [4].

For our research, we use p-Si/ITO barrier structures with different size of CdTe quantum dots deposited to the surface of silicon and a reference sample without CdTe. Indium tin oxide (ITO) is a ternary composition of indium, tin and oxygen in varying proportions. Because of the large bandgap and high conductivity, it is mostly transparent electrode in the visible part of the spectrum.

We have investigated J-V characteristics for these structures at room and liquid nitrogen temperatures. The J-V characteristics were found to be nonlinear due to presence of depletion layer. In addition, photovoltage and photocurrent spectra were studied. The photocurrent in spectral range $h\nu$>1.6 eV, above band gap of Si, is caused mainly by presence of the CdTe quantum dots. The contribution of quantum dots to the photocurrent signal depends on the applied bias voltage and morphology of the CdTe nanoobjects.

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