Overview

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Chemical Structures
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Synthesis
Their optimal efficiency is 65%, compared to 40.7% from single band solar cells.

A QD-SC utilizes the nano-scale quantum mechanical properties to allow for more efficient excitation of light by increasing surface area.

The chemical structures of the two types of quantum dots are In$_y$Ga$_{1-y}$As and GaAs$_{1-x}$P$_x$, although the composition may change depending on what is being studied.iii

A typical concentration of QDs is 100%, as the active sub-units of each cell are made of QDs.

Intermediate Band Quantum Dot Solar Cell Diagram

iii Voicu Popescu, Gabriel Bester,* Mark C. Hanna, Andrew G. Norman, and Alex Zunger. “Theoretical and experimental examination of the intermediate-band concept for strain-balanced (In,Ga)As/Ga(As,P) quantum dot solar cells”. PHYSICAL REVIEW B 78, 205321 _2008_
Uses

- Microwave frequency integrated circuits
- Infrared light-emitting diodes
- Monolithic microwave integrated circuits
What's The Problem?

The largest problem with the QD chemical structure given is that it contains both arsenic, a toxic heavy metal, and indium. The average price being $968 for 100g of pure metal.
Most spectroscopic techniques used for characterization act on bulk quantities such as solutions and solid crystals. For QDs, these methods are unviable because the nanometer scale of the structures makes them incapable of interacting with the instrumentation in a useful fashion. The methods by which these nano-structures are characterized utilize their interaction with electrical and magnetic fields.
This depicts the absorbance of different types of quantum dots versus the incident energy used on them. The undoped QDs show no absorbance at 0.3 eV, whereas the doped QDs show absorbance at this energy. Succinctly, the QD’s utilizing an intermediate band in their superstructure have a noticeably higher absorbance of incident light (incoming photons exciting electrons into excited states) than do QD’s that are undoped at lower energies. Further, doped QD’s continue to have a higher absorbance across all energies up to the low energy cutoff of the detector.

Iii Voicu Popescu, Gabriel Bester,* Mark C. Hanna, Andrew G. Norman, and Alex Zunger. “Theoretical and experimental examination of the intermediate-band concept for strain-balanced (In,Ga)As/Ga(As,P) quantum dot solar cells”. PHYSICAL REVIEW B 78, 205321 _2008_
Synthesis

A Molecular Beam Epitaxy Chamber

The major method of QD synthesis is molecular beam epitaxy. MBE forms an epitaxial layer on a substrate by firing a stream of gaseous atoms or molecules onto it. However, this method requires that the particles do not interact with anything else on their way to the substrate; thus, MBE is performed in ultra-high vacuum conditions. Figure 5 shows an MBE chamber that is being used to create Gallium, Arsenic, and Indium QDs.
Happy Easter!!!!
Have a safe spring break
And don’t
Be This Girl
Or This Guy

FAIL

Or This Guy

FAIL
But We All Know This Is Going To Happen........