Report 0c

Solar Cell

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Fundamentally, solar cells represent a p-n junction that can generate electron-hole pairs upon electromagnetic waves excitation. The p-n junctions result from attaching (using some fabrication techniques) positively and negatively doped materials such as silicon-boron and silicon-phosphorous respectively. Before the p-n junction formation both materials are neutral. However, electrons (from the negatively doped material) and holes (from the positively doped material) tend to diffuse to the other side due to the concentration difference at the interface which creates a depletion region that is not neutral and thus a voltage potential difference is created as well. This voltage start deaccelerating the diffused charges until an equilibrium state is achieved.

Now, electromagnetic waves with energies (plank constant multiplied by their frequencies) greater than the band gab (between the valence and conduction bands) are capable of generating electron-hole pairs within the depletion region “generation current or photogenerated current”. These are accelerated by the previously built up voltage potential to move in the reverse direction. Reduction of this current happens due to the recombination current which happens when electron-hole pairs cancel out and other parasitic effects still appear when data is obtained experimentally.

The basic model (which was obtained many years ago) consist of independent current sources representing the photogenerated current (assuming it is constant for a specific type of illumination), single diode representing the physical structure of the cell and the parasitic effects are modeled by a series and parallel resistors.

Upon some conditions, the experimentally observed I-V characteristics of the cell shows an S-shape that can only be modeled by adding another diode to the configuration.