J Laser Opt Photonics 2018, Volume 5
DOI: 10.4172/2469-410X-C4-033

Spatial architecture impact in mediation open circuit voltage control of quantum solar cell recovery systems

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The photocurrent generations are influencing ultra-high efficiency solar cells based on autopoietic self-assembled quantum dots (QDs) nanostructures. Nanocrystal quantum dots (QD) provide a great enhancement toward solar cell efficiencies, through the use of quantum confinement to tune absorbance across the solar spectrum enabled multi-exciton generation. Based on theoretical predictions, QDs have the potential to improve systems efficiency in approximate regular electrons excitation intensity greater than 50%. In solar cell devices, an intermediate band is formed by the electron levels in quantum dot systems. Spatial architecture is exploring how a solar cell can integrate to produce not only high open circuit voltages (>1.7 eV) but also large short-circuit currents due to the efficient absorption of sub band gap photons. In the proposed QD system, the structure allows barrier material to absorb wavelengths below 700 nm while multi-photon processes in the used quantum dots to absorb wavelengths up to 2 μm. The structure and material compositions are flexible to tune the energy bandgap of the barrier material and quantum dot to their respective optimum values. This structure is expected to outperform single or multi-junction solar cells in terms of energy virtual conversion efficiency and cost. A key milestone towards achieving the claimed high-efficiency solar cell device is flexibly tuning the energy bandgap between the barrier material and QD according to the designed limits. Despite this remarkable potential for high photocurrent generation, the achievable open-circuit voltage (Voc) is fundamentally limited due to non-radiative recombination processes in QD solar cells. The orientation of voltage recovery system is compared theoretically with experimental Voc variation in mediation upper-limit obtained from one diode modeling at the cells with different bandgap (Eg) and classified in proposed spatial architecture. The opportunity for improvement Voc is valued approximately greater than 1V by using smaller QDs through QD solar cell recovery systems as confined other micro and nano operations states.

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