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Simulation of single quantum well solar cells

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III-V solar cells have been extensively studied in both theoretical and experimental aspects. The efficiency of the solar cells can be enhanced by the insertion of quantum structures as a result of the quantized energy levels at which photons with energy lower than the host material can be absorbed. A window layer made of a wide band gap material increases the absorption of high energy photons but is transparent to photons absorbed by the next layers. The window layer also decreases the surface recombination. AlGaAs is one of the material used as a window layer and exhibits good optical absorption properties. Furthermore, AlGaAs has a lattice constant nearly matched to GaAs which is a well-known substrate, meaning that AlGaAs can be grown on GaAs with very low defect density. To design and optimize the solar cell structure, numerical simulation is very crucial as the fundamental phenomena of solar cell operation can be visualized prior to the implementation of real devices. In this work, a solar cell consisting of a single AlGaAs/GaAs quantum well with an AlGaAs window layer is simulated to gain the understanding in the influence of the quantum structure and the window layer on the solar cell performance. Other important parameters such as layer thickness and doping concentration are also varied to examine their effects.

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