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Theoretical energy conversion efficiency which has a light absorption layer of nm-scale dopant-rich region located in the depletion layer

Abstract: The nm-scale n-type dopant rich region in p-type silicon crystal can form nm-scale plus charged electric field. This electric field can confine free electrons by potential barriers which have variety of energy ranging from 0eV to 5eV. This is anticipated by calculating the value of potential barrier of those regions (hereinafter" Region") from Ritz variational method. In our research, we tried to prove that these Region can be used for photon absorbing layer for solar cell.

With the resonance absorption between photon energy and Region potential barrier, unavoidable losses (thermal loss and passing loss) can be eliminated basically.

With the light absorption layer of high density of Regions, the high value of light absorption coefficient can be derived. This high value of light absorption coefficient can realize thin absorption layer with sufficient light absorption. The thin thickness of the absorption layer can locate the layer itself in depletion layer which has sufficiently strong electric field. This electric field can drive away the electrons from the Region layer where they may recombine. To evaluate this effect, assuming some reduction rates of the recombination, numerical calculation has been carried out. From those result, especially high energy conversion efficiency was derived.

In the presentation, this calculation method will be explained in detail.

Keywords: Energy conversion efficiency, nm-scale dopant rich region, light absorption coefficient, resonance absorption, Silicon crystal solar cell

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