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Si solar cells with higher efficiency for picking up photons in ultraviolet and infrared region of solar spectra

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Surface-induced effects on micro-nanopattern and quantum confinement effect in Si nanostructures offer interesting features that could be used to boost the efficiency of photovoltaic energy conversion and to overcome some of the restraints that lead to the Shockley-Queisser limit. Micro-nanostructuring has been suggested as a promising method to find a new path to get an effective absorber for solar cells with higher efficiency in a photovoltaic system. Recently, significant effort has been focused on enhancing the light absorption by nanoscale light trapping using nanowires, nanocones, nanodomes and nanoholes. Despite the exciting success in light trapping, the power conversion efficiency of nano-structured Si solar cells, however, remain lower efficiency for the thick devices and the thin devices. The Si solar cells with nanostructures are not efficient because of severe Auger recombination. In addition it is also needed for Si solar cells with higher efficiency to pick up photons in ultraviolet and infrared region of solar spectra. Here, we have found the new methods in which the localized electronic states with longer lifetime due to the Heisenberg principle related to t~h/E are built from the impurities on the nanostructures for avoiding severe Auger recombination, which involve the electronic states due to impurities built on the smaller nanostructures doped with oxygen and the electronic states owing to impurities built on the defects doped with oxygen for improving photovoltaic conversion in ultraviolet and infrared regions.

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