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(aSiGe/ncSi) superlattice thin film silicon solar cell

Abstract

Nanocrystalline silicon solar cell has come up as a potential material in the photovoltaic industry. There are various benefits of nanocrystalline silicon which makes it superior to its counterparts such as amorphous silicon and amorphous silicon germanium. Narrow band gap of 1.12eV helps to generate more current by utilizing the red and infrared region of the solar spectrum. High current producing ability makes it suitable material for the bottom cell of a tandem solar cell. The growth of nanocrystalline silicon is not as simple as the growth of amorphous silicon. The material grows in a conical fashion which results to large grain boundary formation if not controlled properly. The large grain boundaries hamper the electronic properties of the material. To prevent the formation of the large grain boundaries several design of nanocrystalline silicon solar cell has been used. Hydrogen profile, Power profile and Superlattice structures help to control the crystallinity of the material as it grows. There are other deposition parameters such as deposition temperature, pressure and frequency if changed may alter the morphology of the material by changing the grain size of crystals. For high mobility and more absorption of photons we need large grains sizes of <220> which can be achieved by high temperature and high pressure deposition conditions. We are going to discuss about the superlattice structure and ways to improve the quality of the solar cell. Amorphous silicon germanium has superior absorption coefficient as compared to amorphous silicon therefore in this report we would discuss how we can incorporate amorphous silicon germanium with nanocrystalline silicon to enhance the current of the solar cell. The grain structure and superior electronic property of nanocrystalline silicon will be utilized to collect the carriers from the thin amorphous silicon germanium tissue. We will also show the increase in current can be achieved by incorporating a back-reflector in a solar cell.