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An investigation of crystalline thin-film Six/Ge 1-x/Si solar cells

Abstract

Thin film solar cells have attracted a lot of attention due to their potential for increased efficiency and reduction in cost of material. Thin-film crystalline silicon solar cells are fundamentally limited in efficiency due to (a) incomplete optical absorption and (b) inability to absorb in far infra red region. Germanium alloys with silicon with varying composition have the capability to both enhance absorption and extend the bandgap. An appropriately-located $Si_{1-x}Ge_x$ layer in the thin film c-Si device configuration has the potential to enhance the efficiency of current thin film c-Si solar cells. PC1D investigation of thin film c-Si solar cells by incorporating a graded layer structure into a solar cell configuration has been carried out. Si_xGe_{1-x} insertion has led to higher efficiency. Simulation of $Si_{1-x}Ge_x$ alloy is performed over a wide range of germanium concentrations ~ (10%-90%). Simulations indicate that either Ge or Si_xGe_{1-x}, when integrated into the thin-film c-Si solar cell configuration, structure; strongly influence the device performance through tailoring the absorption properties.

Keywords; IQE; PCID; SixGe1-x solar cells; Screen-printed; Silicon; Germanium