SOLAR CELL HAVING AN EMITTER REGION WITH WIDE BANDGAP SEMICONDUCTOR MATERIAL

TECHNICAL FIELD

[0001] Embodiments of the present invention are in the field of renewable energy and, in particular, solar cells having emitter regions composed of wide bandgap semiconductor material.

BACKGROUND

[0002] Photovoltaic cells, commonly known as solar cells, are well known devices for direct conversion of solar radiation into electrical energy. Generally, solar cells are fabricated on a semiconductor wafer or substrate using semiconductor processing techniques to form a p-n junction near a surface of the substrate. Solar radiation impinging on the surface of, and entering into, the substrate creates electron and hole pairs in the bulk of the substrate. The electron and hole pairs migrate to p-doped and n-doped regions in the substrate, thereby generating a voltage differential between the doped regions. The doped regions are connected to conductive regions on the solar cell to direct an electrical current from the cell to an external circuit coupled thereto

[0003] Efficiency is an important characteristic of a solar cell as it is directly related to the capability of the solar cell to generate power. Likewise, efficiency in producing solar cells is directly related to the cost effectiveness of such solar cells. Accordingly, techniques for increasing the efficiency of solar cells, or techniques for increasing the efficiency in the manufacture of solar cells, are generally desirable. Some embodiments of the present invention allow for increased solar cell manufacture efficiency by providing novel processes for fabricating solar cell structures. Some embodiments of the present invention allow for increased solar cell efficiency by providing novel solar cell structures.

~~BRIEF DESCRIPTION OF THE DRAWINGS~~

~~**[0004]** Figure 1 illustrates a band diagram as a function of increasing energy (E) for a conventional heterojunction contact without an interfacial tunnel oxide.~~

SUMMARY OF INVENTION

[0003a] According to an aspect of the invention, there is provided a method of fabricating a solar cell, the method comprising: forming, in a process tool having a controlled atmosphere, a thin dielectric layer on a surface of a semiconductor substrate of the solar cell, the semiconductor substrate having a bandgap; and, without removing the semiconductor substrate from the controlled atmosphere of the process tool, forming a semiconductor layer on the thin dielectric layer, the semiconductor layer having a bandgap at least approximately 0.2 electron Volts (eV) above the bandgap of the semiconductor substrate.

[0003b] According to another aspect of the invention, there is provided a method of fabricating a solar cell, the method comprising: forming a first emitter region on a surface of a semiconductor substrate of the solar cell, the first emitter region comprising a semiconductor material doped to a first conductivity type and formed on a first thin dielectric layer; and forming a second emitter region on the surface of the semiconductor substrate, the forming comprising: forming, in a process tool having a controlled atmosphere, a second thin dielectric layer on the surface of the semiconductor substrate, the semiconductor substrate having a bandgap; and, without removing the semiconductor substrate from the controlled atmosphere of the process tool, forming a wide bandgap semiconductor layer on the second thin dielectric layer, the wide bandgap semiconductor layer having a bandgap at least approximately 0.2 electron Volts (eV) above the bandgap of the semiconductor substrate; and doping the wide bandgap semiconductor layer with charge carrier dopant impurity atoms of a second, opposite, conductivity type.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Figure 1 illustrates a band diagram as a function of increasing energy (E) for a conventional heterojunction contact without an interfacial tunnel oxide.