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 deposited on the surface of the semiconductor substrate; 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.

texturizing the surface of the semiconductor substrate prior to forming the thin dielectric layer.

15. The method of claim 1, wherein forming the thin dielectric layer and the semiconductor layer on the surface of the semiconductor substrate comprises forming on a back-contact surface of the semiconductor substrate, the forming further comprising forming the thin dielectric layer and the semiconductor layer on a light-receiving surface of the semiconductor substrate.

~~16. A solar cell fabricated according to the method of claim 1.~~

16~~17~~. 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 deposited on the surface of the semiconductor substrate; 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.

17~~18~~. The method of claim 16~~17~~, wherein the semiconductor substrate comprises single-crystalline N-type silicon, and wherein forming the wide bandgap semiconductor layer comprises forming a semiconductor layer having a bandgap greater than approximately 1.5 eV and comprising a material selected from the group consisting of

amorphous silicon (a-Si), silicon carbide, aluminum nitride (AlN), aluminum gallium nitride ($Al_xGa_{1-x}N$, where $0 < x < 1$), and boron nitride (BN).

18~~19~~. The method of claim 16~~17~~, further comprising:

texturizing the surface of the semiconductor substrate prior to forming the second thin dielectric layer.

~~20. A solar cell fabricated according to the method of claim 17.~~