an N-type silicon layer disposed on the intrinsic silicon layer, wherein one or both of the intrinsic silicon layer and the N-type silicon layer is a micro- or poly-crystalline silicon layer.

[0003b] According to a second aspect, a solar cell is provided, comprising:

a silicon substrate having a light-receiving surface;

a passivating dielectric layer disposed on the light-receiving surface of the silicon substrate;

an intrinsic silicon layer disposed above the passivating dielectric layer

and

an N-type micro- or poly-crystalline silicon layer disposed on the passivating dielectric layer.

[0003c] According to a third aspect, a method of fabricating a solar cell is provided, comprising:

forming a passivating dielectric layer on a light-receiving surface of a silicon substrate;

forming an intrinsic silicon layer disposed above the passivating dielectric layer

forming an N-type micro- or poly-crystalline silicon layer above the passivating dielectric layer; and

forming an anti-reflective coating (ARC) layer on the N-type micro- or poly-crystalline silicon layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Figures 1A-1E illustrate cross-sectional views of various stages in the fabrication of a solar cell, in accordance with an embodiment of the present disclosure, wherein:

[0005] Figure 1A illustrates a starting substrate of a solar cell;

[0006] Figure 1B illustrates the structure of Figure 1A following formation of a passivating dielectric layer on a light-receiving surface of the substrate;

[0007] Figure 1C illustrates the structure of Figure 1B following formation of an intrinsic silicon layer on the passivating dielectric layer;

CLAIMS

What is claimed is:

1. A solar cell, comprising:

a silicon substrate having a light-receiving surface;

an intrinsic silicon layer disposed above the light-receiving surface of the silicon substrate; and

an N-type silicon layer disposed on the intrinsic silicon layer, wherein one or both of the intrinsic silicon layer and the N-type silicon layer is a micro- or poly-crystalline silicon layer.

2. The solar cell of claim 1, wherein the N-type silicon layer is an N-type micro- or poly-crystalline silicon layer having a crystalline fraction in the range of 0.1-0.9, with the balance being amorphous.

3. The solar cell of claim 2, wherein a concentration of N-type dopants in the N-type micro- or poly-crystalline silicon layer is in the range of 1E17 – 1E20 atoms/cm^3.

4. The solar cell of claim 1, further comprising:

a passivating dielectric layer disposed on the light-receiving surface of the silicon substrate, wherein the intrinsic silicon layer is disposed on the passivating dielectric layer.

5. The solar cell of claim 4, wherein the passivating dielectric layer is a layer of silicon dioxide (SiO_2) having a thickness in the range of 10-200 Angstroms.

6. The solar cell of claim 1, further comprising:

an anti-reflective coating (ARC) layer disposed on the N-type silicon layer.

7. The solar cell of claim 1, wherein the light-receiving surface has a texturized topography, and wherein both the intrinsic silicon layer and the N-type silicon layer are conformal with the texturized topography of the light-receiving surface.

8. The solar cell of claim 1, wherein the substrate further comprises a back surface opposite the light-receiving surface, the solar cell further comprising:

a plurality of alternating N-type and P-type semiconductor regions at or above the back surface of the substrate; and

a conductive contact structure electrically connected to the plurality of alternating N-type and P-type semiconductor regions.

9. A solar cell, comprising:

a silicon substrate having a light-receiving surface;

a passivating dielectric layer disposed on the light-receiving surface of the silicon substrate;

an intrinsic silicon layer disposed above the passivating dielectric layer; and

an N-type micro- or poly-crystalline silicon layer disposed on the passivating dielectric layer.

10. The solar cell of claim 9, wherein the N-type micro- or poly-crystalline silicon layer has a crystalline fraction in the range of 0.1-0.9, with the balance being amorphous.

11. The solar cell of claim 10, wherein a concentration of N-type dopants in the N-type micro- or poly-crystalline silicon layer is in the range of 1e17-1e20 atoms/cm^3.

12. The solar cell of claim 9, further comprising:

an anti-reflective coating (ARC) layer disposed on the N-type micro- or poly-crystalline silicon layer.

13. The solar cell of claim 9, wherein the passivating dielectric layer is a layer of silicon dioxide (SiO_2) having a thickness in the range of 10-200 Angstroms.

14. The solar cell of claim 9, wherein the light-receiving surface of the substrate has a texturized topography, and wherein the N-type micro- or poly-crystalline silicon layer is conformal with the texturized topography of the light-receiving surface.

15. The solar cell of claim 9, wherein the substrate further comprises a back surface opposite the light-receiving surface, the solar cell further comprising:

a plurality of alternating N-type and P-type semiconductor regions at or above the back surface of the substrate; and

a conductive contact structure electrically connected to the plurality of alternating N-type and P-type semiconductor regions.

16. A method of fabricating a solar cell, the method comprising:

forming a passivating dielectric layer on a light-receiving surface of a silicon substrate;

forming an intrinsic silicon layer on the passivating dielectric layer;

forming an N-type micro- or poly-crystalline silicon layer above the passivating dielectric layer; and

forming an anti-reflective coating (ARC) layer on the N-type micro- or poly-crystalline silicon layer.

17. The method of claim 16, wherein forming an N-type micro- or poly-crystalline silicon layer comprises depositing an N-type amorphous silicon layer and, subsequently, phase converting the N-type amorphous silicon layer to the N-type micro- or poly-crystalline silicon layer.

18. The method of claim 16, wherein forming an N-type micro- or poly-crystalline silicon layer comprises depositing the N-type micro- or poly-crystalline silicon layer.

19. The method of claim 16, further comprising:

forming an intrinsic micro- or poly-crystalline or amorphous silicon layer on the passivating dielectric layer, wherein forming the N-type micro- or poly-crystalline silicon layer comprises forming on the intrinsic micro- or poly-crystalline or amorphous silicon layer.

20. The method of claim 16, wherein forming the passivating dielectric layer comprises using a technique selected from the group consisting of chemical oxidation of a portion of the light-receiving surface of the silicon substrate, plasma-enhanced chemical vapor deposition (PECVD) of silicon dioxide (SiO_2), atomic layer deposition (ALD) of SiO_2 or AlOx, thermal oxidation of a portion of the light-receiving surface of the silicon substrate, and exposure of the light-receiving surface of the silicon substrate to ultra-violet (UV) radiation in an O_2 or O_3 environment.

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