Enhanced Adhesion of Seed Layer for Solar Cell Conductive Contact

TECHNICAL FIELD

[0001] Embodiments of the present invention are in the field of renewable energy and, in particular, enhanced adhesion of seed layers for solar cell conductive contacts and methods of forming solar cell conductive contacts.

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.

SUMMARY

[0003a] According to the first aspect, a solar cell is provided, comprising

a substrate;

an N-type emitter region disposed above the substrate; and

a conductive contact disposed on and electrically connected to the N-type emitter region, the conductive contact comprising a mixture of a metal paste portion and a P-type silicon portion, the metal paste portion and the P-type silicon portion of the mixture in contact with the N-type emitter region.

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

a substrate having an N-type diffusion region at or near a surface of the substrate; and

a conductive contact disposed above and electrically connected to the N-type diffusion region, the conductive contact comprising a mixture of a metal paste portion and a P-type silicon portion, the metal paste portion and the P-type silicon portion of the mixture in contact with the N-type diffusion region.

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

forming an adhesion layer above an N-type emitter region of a substrate;

wherein the adhesion layer comprises P-type silicon; and

subsequent to forming the adhesion layer above the N-type emitter region, forming a metal seed paste layer on the adhesion layer;

annealing the metal seed paste layer and the adhesion layer to form a conductive mixture layer in contact with the N-type emitter region of the substrate;

wherein the metal paste portion and the P-type silicon portion of the mixture in contact with the N-type emitter region; and

forming a conductive contact for the solar cell from the conductive layer.

BRIEF DESCRIPTION OF THE DRAWINGS

[0004] Figures 1A-1D illustrate cross-sectional views of various operations in a method of fabricating a contact for a solar cell, in accordance with an embodiment of the present invention.

[0005] Figure 2A illustrates a cross-sectional view of a portion of a solar cell having conductive contacts formed on emitter regions formed above a substrate, in

CLAIMS

What is claimed is:

1. A solar cell, comprising:

a substrate;

an N-type emitter region disposed above the substrate; and

a conductive contact disposed on and electrically connected to the N-type emitter region, the conductive contact comprising a mixture of a metal paste portion and a P-type silicon portion, the metal paste portion and the P-type silicon portion of the mixture in contact with the N-type emitter region.

2. The solar cell of claim 1, wherein the metal paste portion comprises aluminum (Al), and the mixture comprises an Al-Si alloy.

3. The solar cell of claim 1, wherein the mixture has a thickness of approximately 2-10 microns, and wherein the conductive contact is a back contact of the solar cell comprising the mixture, an electroless plated nickel (Ni) layer disposed on the mixture, and an electroplated copper (Cu) layer disposed on the Ni layer.

4. A solar cell, comprising:

a substrate having an N-type diffusion region at or near a surface of the substrate; and

a conductive contact disposed above and electrically connected to the N-type diffusion region, the conductive contact comprising a mixture of a metal paste portion and a P-type silicon portion, the metal paste portion and the P-type silicon portion of the mixture in contact with the N-type diffusion region.

5. The solar cell of claim 4, wherein the metal paste portion comprises aluminum (Al), and the mixture comprises an Al-Si alloy.

6. The solar cell of claim 4, wherein the mixture has a thickness of approximately 2-10 microns, and wherein the conductive contact is a back contact of the solar cell comprising the mixture, an electroless plated nickel (Ni) layer disposed on the mixture, and an electroplated copper (Cu) layer disposed on the Ni layer.

7. A method of fabricating solar cell, the method comprising:

forming an adhesion layer above an N-type emitter region of a substrate;

wherein the adhesion layer comprises P-type silicon; and

subsequent to forming the adhesion layer above the N-type emitter region, forming a metal seed paste layer on the adhesion layer;

annealing the metal seed paste layer and the adhesion layer to form a conductive mixture layer in contact with the N-type emitter region of the substrate;

wherein the metal paste portion and the P-type silicon portion of the mixture in contact with the N-type emitter region; and

forming a conductive contact for the solar cell from the conductive layer.

8. The method of claim 7, wherein annealing the metal seed paste layer and the adhesion layer comprises mixing the metal seed paste layer and the adhesion layer to form the conductive layer.

9. The method of claim 7, wherein forming the metal paste portion comprises aluminum (Al), and the mixture comprises an Al-Si alloy.

10. The method of claim 7, wherein the conductive layer has a thickness of approximately 2-10 microns, and wherein forming the conductive contact comprises forming a back contact of the solar cell comprising the conductive layer, an electroless plated nickel (Ni) layer formed on the conductive layer, and an electroplated copper (Cu) layer formed on the Ni layer.