FOIL-BASED METALLIZATION OF SOLAR CELLS

TECHNICAL FIELD

[0001] Embodiments of the present disclosure are in the field of renewable energy and, in particular, include approaches for foil-based metallization of solar cells and the resulting solar cells.

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 disclosure allow for increased solar cell manufacture efficiency by providing novel processes for fabricating solar cell structures. Some embodiments of the present disclosure allow for increased solar cell efficiency by providing novel solar cell structures.

SUMMARY

[0003a] According to a first aspect, a method of fabricating a solar cell is provided, comprising forming a plurality of alternating N-type and P-type semiconductor regions in or above a substrate; adhering a metal foil to the alternating N-type and P-type semiconductor regions; laser ablating through only a portion of the metal foil at regions corresponding to locations between the alternating N-type and P-type semiconductor regions; and subsequent to the laser ablating, isolating regions of the remaining metal foil corresponding to the alternating N-type and P-typesemiconductor regions.

[0003b] According to a second aspect, a method of fabricating a solar cell is provided, forming a plurality of alternating N-type and P-type semiconductor regions in or above a substrate; adhering an anodized metal foil to the alternating N-type and P-type semiconductor regions, the anodized metal foil having an anodized top surface and an anodized bottom surface with a metal portion there between, wherein adhering the anodized metal foil to the alternating N-type and P-type semiconductor regions comprises breaking through regions of the anodized bottom surface of the anodized metal foil; and laser ablating through the anodized top surface and the metal portion of the anodized metal foil at regions corresponding to locations between the alternating N-type and P-type semiconductor regions, wherein the laser ablating terminates at the anodized bottom surface of the anodized metal foil isolating regions of the remaining metal foil corresponding to the alternating N-type and P-type semiconductor regions.

[0003c] According to a third aspect, a solar cell is provided comprising a substrate; a plurality of alternating N-type and P-type semiconductor regions disposed in or above the substrate; and a conductive contact structure disposed above the plurality of alternating N-type and P-type semiconductor regions, the conductive contact structure comprising: a plurality of metal seed material regions providing a metal seed material region disposed on each of the alternating N-type and P-type semiconductor regions; and a metal foil disposed on the plurality of metal seed material regions, the metal foil having anodized portions isolating metal regions of the metal foil corresponding to the alternating N-type and P-type semiconductor regions.

BRIEF DESCRIPTION OF THE DRAWINGS

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

[0005] Figure 1A illustrates a stage in solar cell fabrication following formation of optional metal seed regions on emitter regions formed above a portion of a back surface of a substrate of a solar cell;

[0006] Figure 1B illustrates the structure of Figure 1A following optional formation of a protection layer;