BCBJ solar cells may be prevalent when the cell architecture has metal of one polarity over diffusions of another polarity.

[0005] To compete with other energy sources available on the market, solar cells not only have to be efficient but also fabricated at relatively low cost and high yield. Embodiments of the present invention pertain to novel solar cell fabrication processes and structures that reduce the cost of solar cell fabrication and improve solar cell reliability.

BRIEF SUMMARY

[0005a] In one aspect, a solar cell is provided, comprising

a plurality of P-type diffusion regions and a plurality of N-type diffusion regions;

a P-type metal contact that is electrically coupled to the P-type diffusion regions;

an N-type metal contact that is electrically coupled to the N-type diffusion regions and is directly over a P-type diffusion region;

a first dielectric layer over the plurality of P-type diffusion regions and N-type diffusion regions, the first dielectric layer comprising contact holes that expose the N-type diffusion regions but not the P-type diffusion regions, the N-type metal contact being electrically coupled to the N-type diffusion regions through the contact holes; and

a second dielectric layer between the N-type metal contact and the first dielectric layer, the second dielectric layer being disposed between two adjacent contact holes of the first dielectric layer.

[0005b] In another aspect, a process of fabricating a solar cell is provided:

forming a first dielectric layer over a plurality of diffusion regions of a first conductivity type and a plurality of diffusion regions of a second conductivity type on a backside of the solar cell;

forming a second dielectric layer over the first dielectric layer;

after forming the first and second dielectric layers, using a laser to form a plurality of contact holes through the first dielectric layer but not through the second dielectric layer to expose the plurality of diffusion regions of the first conductivity type but not the plurality of diffusion regions of the second conductivity type; and

forming a metal layer over the first dielectric layer and the second dielectric layer, the metal layer forming metal contacts to the plurality of diffusion regions of the first conductivity type through the plurality of contact holes.

[0005c] In another aspect, a solar cell is provided, comprising:
a plurality of diffusion regions of a first conductivity type and a plurality of diffusion regions of a second conductivity type on a backside of a solar cell;
a first metal contact that is electrically coupled to the diffusion regions of the first conductivity type and is directly over a diffusion region of the second conductivity type;
a second metal contact that is electrically coupled to the diffusion regions of the second conductivity type;
an interlayer dielectric over the diffusion regions of the first conductivity type and the diffusion regions of the second conductivity type, the interlayer dielectric layer comprising contact holes through which the first metal contact electrically couples to the diffusion regions of the first conductivity type; and
a sacrificial layer between the interlayer dielectric and the first metal contact, the sacrificial layer being disposed between two adjacent contact holes of the interlayer dielectric.

[0006] In one embodiment, contact holes of solar cells are formed by laser ablation to accommodate various solar cell designs. Use of a laser to form the contact holes is facilitated by replacing films formed on the diffusion regions with a film that has substantially uniform thickness. The film thickness as absorption may be tailored to match laser parameters. Dopant depth underneath contact holes may be controlled to increase the laser ablation process margins. The laser configuration may be tailored to form contact holes through dielectric films of varying thicknesses.

[0007] These and other features of the present invention will be readily apparent to persons of ordinary skill in the art upon reading the entirety of this disclosure, which includes the accompanying drawings and claims.

BRIEF DESCRIPTION OF THE DRAWINGS

[0008] A more complete understanding of the subject matter disclosed herein may be derived by referring to the detailed description and claims when considered in conjunction with the following figures, wherein like reference numbers refer to similar elements throughout the figures. The figures are not drawn to scale.

[0009] FIG. 1 schematically shows an example BCBJ solar cell with metal contacts that are formed over opposite polarity diffusion regions.

[0010] FIG. 2 shows a top view of the solar cell of FIG. 1.

[0011] FIG. 3 shows a cross-section of the solar cell of FIG. 1 taken at section A-A of FIG. 2.

[0012] FIGS. 4-6 show cross-sections of a solar cell being fabricated in accordance with an embodiment of the present invention.

[0013] FIG. 7 shows another top view of the solar cell of FIG. 1.