

6. The method of claim 1, wherein forming the silicon layer comprises forming the silicon layer on a thin dielectric layer disposed on the substrate, wherein the substrate is a monocrystalline silicon substrate.

7. The method of claim 1, wherein the implanting through the first and second shadow masks comprises implanting through first and second graphite shadow masks, respectively, and wherein the first and second graphite shadow masks are sequentially positioned off of, but in close proximity to, the silicon layer.

8. The method of claim 1, further comprising:
forming conductive contacts on the doped polycrystalline silicon emitter regions.

9. A method of fabricating an emitter region of a solar cell, the method comprising:
forming a silicon layer above a substrate;
forming a carbosilane layer on the silicon layer;
implanting, through a shadow mask, dopant impurity atoms in the carbosilane layer and the silicon layer to form implanted silicon regions and corresponding self-aligned implanted regions of the carbosilane layer, and resulting in non-implanted regions of the silicon layer and corresponding non-implanted regions of the carbosilane layer;
removing the non-implanted regions of the silicon layer and the non-implanted regions of the carbosilane layer, wherein the implanted regions of the carbosilane layer protect the implanted regions of the silicon layer during the removing; and
annealing the implanted regions of the silicon layer to form doped polycrystalline silicon emitter regions.

10. The method of claim 9, further comprising:
subsequent to the annealing, removing the implanted regions of the carbosilane layer; and
forming conductive contacts on the doped polycrystalline silicon emitter regions.

11. The method of claim 9, further comprising:
forming conductive contacts through the implanted regions of the carbosilane layer, on the doped polycrystalline silicon emitter regions.

12. The method of claim 9, wherein forming the silicon layer comprises forming a hydrogenated amorphous silicon layer.

5 13. The method of claim 12, wherein forming the hydrogenated amorphous silicon layer and forming the carbosilane layer comprise using plasma enhanced chemical vapor deposition (PECVD).

14. The method of claim 9, wherein removing the non-implanted regions of the silicon layer and the non-implanted regions of the carbosilane layer comprises using a hydroxide-based wet etchant to
10 texturize exposed portions of the substrate.

15. The method of claim 9, wherein forming the silicon layer comprises forming the silicon layer on a thin dielectric layer disposed on the substrate, and wherein the substrate is a monocrystalline silicon substrate.

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16. The method of claim 9, wherein implanting through the shadow mask comprises implanting through a graphite shadow mask, and wherein the graphite shadow mask is positioned off of, but in close proximity to, the silicon layer.

20 17. A solar cell fabricated according to the method of claim 9.

18. A back contact solar cell, comprising:

a monocrystalline silicon substrate having a light-receiving surface and a back surface;
a thin dielectric layer disposed on the back surface of the monocrystalline silicon substrate;
25 a polycrystalline silicon emitter region disposed on the thin dielectric layer, the polycrystalline silicon emitter region doped with impurity atoms;
a carbosilane layer disposed on, and aligned with, the polycrystalline silicon emitter region; and
a conductive contact structure disposed through the carbosilane layer and on the polycrystalline silicon emitter region.

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19. The back contact solar cell of claim 18, wherein the carbosilane layer is also doped with the impurity atoms.