

follows.

Disclosed herein is a main-gate-free and high-efficiency back-contact solar cell module, comprising solar cells and an electrical connection layer, a backlight side of the solar cells having P-electrodes connected to a P-type doping layer and N-electrodes connected to an N-type doping layer, wherein the electrical connection layer comprises a number of small conductive gate lines, part of which are connected to the P-electrodes on the backlight side of the solar cells while the other part of which are connected to the N-electrodes on the backlight side of the solar cells; and the small conductive gate lines are of a multi-section structure; wherein leads are provided in the electrical connection layer; the leads connect a number of small conductive gate lines connected to the P-electrodes of first solar cells; and the leads connect a number of small conductive gate lines connected to the N-electrodes of second solar cells, wherein the leads are vertically connected to a center line of the number of small conductive gate lines ;

wherein the P-electrodes are dotted P-electrodes, and the N-electrodes are dotted N-electrodes;

wherein the diameter of the dotted P-electrodes is 0.2 mm to 1.5 mm, the distance between two adjacent dotted P-electrodes connected to a same small conductive gate line is 0.7 mm to 10 mm; the diameter of the dotted N-electrodes is 0.2 mm to 1.5 mm, the distance between two adjacent dotted N-electrodes connected on a same small conductive gate line is 0.7 mm to 10 mm.

Also disclosed herein is a main-gate-free and high-efficiency back-contact solar cell assembly, comprising fronting material, packaging material, a solar cell layer, packaging material and backing material, which are connected from top to bottom, wherein the solar cell layer comprises a number of solar cell modules, and the solar cell modules refer to the solar cell module as described above.

Further disclosed herein is a method for preparing the main-gate-free and high-efficiency back-contact solar cell assembly as described above, comprising the following steps:

Step 1: connecting solar cell modules in series to form a solar cell layer, an electrical connection layer on a backlight side of each of the solar cell modules having a number of small conductive gate lines connected to P-electrodes and a number of small

conductive gate lines connected to N-electrodes, the small conductive gate lines being of a multi-section structure; electrically connecting a number of leads to electrodes or small conductive gate lines of a first solar cell, and aligning a second solar cell with the first solar cell so that P-electrodes on the second solar cell and N-electrodes on the first solar cell are on a same lead; and, electrically connecting the leads to electrodes or small conductive gate lines of the second solar cell, and repeating the above operations to form a series connection structure, so as to form a solar cell layer; and

Step 2: successively stacking and laminating fronting material, packaging material, the solar cell layer, packaging material and backing material to obtain a solar cell assembly.

A main-gate-free and high-efficiency back-contact solar cell module is provided, comprising solar cells and an electrical connection layer, a backlight side of the solar cells having P-electrodes connected to a P-type doping layer and N-electrodes connected to an N-type doping layer, wherein the electrical connection layer comprises a number of small conductive gate lines, part of which are connected to the P-electrodes on the backlight side of the solar cells while the other part of which are connected to the N-electrodes on the backlight side of the solar cells; and, the small conductive gate lines are of a multi-section structure.

The main-gate-free and high-efficiency back-contact solar cell module provided by the present application may further employ the following auxiliary technical solutions.

The small conductive gate lines are interdigitally arranged in parallel.

An insulating medium capable of preventing the electrodes from turning on is provided between the P-electrodes and the N-electrodes of the solar cells, between the electrodes in the doping layers of the cells and the small conductive gate lines or between the small conductive gate lines.

The P-electrodes are dotted P-electrodes or linear P-electrodes, and the N-electrodes are dotted N-electrodes or linear N-electrodes; and, there are 2 to 17 dotted or linear electrodes interconnected by each conductive gate line.

The diameter of the dotted P-electrodes is 0.2 mm to 1.5 mm, the distance between two adjacent dotted P-electrodes connected to a same small conductive gate line is 0.7 mm to 10 mm, and the width of the linear P-electrodes is 0.4 mm to 1.5 mm; the diameter of the dotted N-electrodes is 0.2 mm to 1.5 mm, the distance between two adjacent dotted N-electrodes connected on a same small conductive gate line is 0.7 mm to 10 mm, and the width of the linear N-electrodes is 0.4 mm to 1.5 mm; and, the total number of the dotted P-electrodes and the dotted N-electrodes is 1000 to 40000.

The dotted electrodes or linear electrodes are made of any one of silver

called a secondary cell. In Embodiment 1, there are total $X-1$ rows of P-electrodes (Y P-electrodes in each row) and X rows of N-electrodes (Y N-electrodes in each row) in the first solar cell, and total $X-1$ rows of N-electrodes (Y N-electrodes in each row) and X rows of P-electrodes (Y P-electrodes in each row) in the second solar cell, where both X and Y are integers greater than 2.

Finally, it should be noted that the forgoing embodiments are merely for describing the technical solutions of the present application, and not intended to limit the protection scope of the present application. Although the present application has been described above in detail by the preferred embodiments, it should be understood by a person of ordinary skill in the art that modifications or equivalent replacements may be made to the technical solutions of the present application without departing from the essence and scope of the technical solutions of the present application.

Many modifications will be apparent to those skilled in the art without departing from the scope of the present invention

Throughout this specification, unless the context requires otherwise, the word "comprise", and variations such as "comprises" and "comprising", will be understood to imply the inclusion of a stated integer or step or group of integers or steps but not the exclusion of any other integer or step or group of integers or steps.

The reference to any prior art in this specification is not, and should not be taken as, an acknowledgment or any form of suggestion that the prior art forms part of the common general knowledge in Australia.

CLAIMS

1. A main-gate-free and high-efficiency back-contact solar cell module, comprising solar cells and an electrical connection layer, a backlight side of the solar cells having P-electrodes connected to a P-type doping layer and N-electrodes connected to an N-type doping layer, wherein the electrical connection layer comprises a number of small conductive gate lines, part of which are connected to the P-electrodes on the backlight side of the solar cells while the other part of which are connected to the N-electrodes on the backlight side of the solar cells; and the small conductive gate lines are of a multi-section structure; wherein leads are provided in the electrical connection layer; the leads connect a number of small conductive gate lines connected to the P-electrodes of first solar cells; and the leads connect a number of small conductive gate lines connected to the N-electrodes of second solar cells, wherein the leads are vertically connected to a center line of the number of small conductive gate lines ;

wherein the P-electrodes are dotted P-electrodes, and the N-electrodes are dotted N-electrodes;

wherein the diameter of the dotted P-electrodes is 0.2 mm to 1.5 mm, the distance between two adjacent dotted P-electrodes connected to a same small conductive gate line is 0.7 mm to 10 mm; the diameter of the dotted N-electrodes is 0.2 mm to 1.5 mm, the distance between two adjacent dotted N-electrodes connected on a same small conductive gate line is 0.7 mm to 10 mm.

2. The main-gate-free and high-efficiency back-contact solar cell module according to claim 1, wherein the small conductive gate lines are interdigitally arranged in parallel.

3. The main-gate-free and high-efficiency back-contact solar cell module according to claim 1, wherein an insulating medium capable of preventing the electrodes from turning on is provided between the P-electrodes and the N-electrodes of the solar cells or between the small conductive gate lines.

4. The main-gate-free and high-efficiency back-contact solar cell module according to claim 1, there are 2 to 17 dotted electrodes interconnected by each conductive gate line.

5. The main-gate-free and high-efficiency back-contact solar cell module according to claim 4, the total number of the dotted P-electrodes and the dotted N-electrodes is 1000 to 40000.

6. The main-gate-free and high-efficiency back-contact solar cell module according to claim 4, wherein the dotted electrodes are made of any one of silver paste, conductive adhesive, conductive polymeric material or tin solder.

7. The main-gate-free and high-efficiency back-contact solar cell module according to claim 1, wherein the small conductive gate lines are made of sintered silver paste or leads, and each of the small conductive gate lines has a width of 10 μm to 300 μm and a width-to-height ratio of 1:0.01 to 1:1.

8. The main-gate-free and high-efficiency back-contact solar cell module according to claim 4, wherein there are 2, 3, 5, 7, 9, 11, 13, 15 or 17 dotted electrodes interconnected by each conductive gate line.

9. The main-gate-free and high-efficiency back-contact solar cell module according to claim 1, wherein the leads and the small conductive gate lines form “ ≡ ”-shaped structures or comb-finger structures, which are arranged crosswise.

10. The main-gate-free and high-efficiency back-contact solar cell module according to claim 1, wherein the surfaces of the leads are plated with anti-oxidation plating material or coated with a conductive adhesive; the anti-oxidation plating material is any one of tin, tin-lead alloy, tin-bismuth alloy or tin-lead-silver alloy; the plating layer or conductive adhesive layer of the leads has a thickness of 5 μm to 50 μm ; the conductive adhesive is a low-resistivity conductive adhesive that uses a conductive particle and a polymeric binder as main components; the conductive particle in the conductive adhesive is any one or more of gold, silver, copper, gold-plated nickel, silver-plated nickel or silver-plated copper, the shape of the conductive particles are any one of a spherical shape, a flake shape, an olivary shape or an acicular shape, and the particle size

of the conductive particle is 0.01 μm to 5 μm ; and, the polymeric binder in the conductive adhesive is any one or more of epoxy resin, polyurethane resin, acrylic resin or organic silicon resin, and the binder is thermosetting or photocurable.

11. The main-gate-free and high-efficiency back-contact solar cell module according to claim 1, wherein the electrical connection layer is provided with P-busbar electrodes and N-busbar electrodes, which are arranged on two sides of the electrical connection layer; and, the surface of the busbar electrodes has a concavo-convex shape.

12. The main-gate-free and high-efficiency back-contact solar cell module according to claim 3, wherein the insulating medium is a thermoplastic resin or a thermosetting resin, and the resin is any one or more of polyimide, polycaprolactam, polyolefin resin, epoxy resin, polyurethane resin, acrylic resin and organic silicon resin.

13. A main-gate-free and high-efficiency back-contact solar cell assembly, comprising fronting material, packaging material, a solar cell layer, packaging material and backing material, which are connected from top to bottom, wherein the solar cell layer comprises a number of solar cell modules, and the solar cell modules refer to the solar cell module according to any one of claims 1 to 12.

14. The main-gate-free and high-efficiency back-contact solar cell assembly according to claim 13, wherein the solar cell modules in the solar cell layer are connected via busbars arranged on two sides of an electrical connection layer.

15. The main-gate-free and high-efficiency back-contact solar cell assembly according to any one of claims 13 to 14, wherein the number of solar cells in the solar cell assembly is 1 to 120.

16. A method for preparing the main-gate-free and high-efficiency back-contact solar cell assembly according to any one of claims 13 to 15, comprising the following steps:

Step 1: connecting solar cell modules in series to form a solar cell layer, an electrical connection layer on a backlight side of each of the solar cell modules

having a number of small conductive gate lines connected to P-electrodes and a number of small conductive gate lines connected to N-electrodes, the small conductive gate lines being of a multi-section structure; electrically connecting a number of leads to electrodes or small conductive gate lines of a first solar cell, and aligning a second solar cell with the first solar cell so that P-electrodes on the second solar cell and N-electrodes on the first solar cell are on a same lead; and, electrically connecting the leads to electrodes or small conductive gate lines of the second solar cell, and repeating the above operations to form a series connection structure, so as to form a solar cell layer; and

Step 2: successively stacking and laminating fronting material, packaging material, the solar cell layer, packaging material and backing material to obtain a solar cell assembly.

17. The method for preparing a main-gate-free and high-efficiency back-contact solar cell assembly according to 16, wherein a solar cell string is prepared in accordance with the Step 1, and the solar cell string comprises at least one solar cell; and, busbar electrodes are arranged on two sides of the solar cell string, and the busbar electrodes are connected in series to form a solar cell layer.

18. The method for preparing a main-gate-free and high-efficiency back-contact solar cell assembly according to any one of claims 16 to 17, wherein a process for preparing the small conductive gate lines is as follows: printing silver paste on the solar cells in segments by screen printing, drying small gate lines of the solar cells having silver paste electrodes printed thereon, and sintering as a whole to obtain a solar cell module with a number of small conductive gate lines.

19. The method for preparing a main-gate-free and high-efficiency back-contact solar cell assembly according to any one of claims 16 to 17, wherein parameters for the laminating operation are set according to the vulcanizing properties of the packaging material; and, the packaging material is EVA and the parameters for the laminating operation are as follows: laminating 9 to 35 min at 120°C to 180°C.

20. The method for preparing a main-gate-free and high-efficiency back-contact solar cell assembly according to any one of claims 16 to 17, wherein the solar cells and the leads in the Step 1 are electrically connected by coating conductive adhesive on a P-type doping layer and an N-type doping layer on the cells by screen printing; the conductive adhesive, when heated, can be solidified to form the P-electrodes and the N-electrodes; and, when heated, the leads and the P-electrodes or the N-electrodes come into Ohm contact by the conductive adhesive, and in this way, the leads and the cells are electrically connected; or

the solar cells and the leads are also electrically connected by plating low-melting-point material on the leads by a plating process; when heated, the leads and the P-type doping layer or the N-type doping layer are welded by the melting of the low-melting-point material to form the P-electrodes and the N-electrodes, and in this way the leads and the solar cells are electrically connected; and the low-melting-point material is any one of tin solder, tin-lead alloy, tin-bismuth alloy or tin-lead-silver alloy; or

the solar cells and the leads can also be electrically connected by laser welding.