CLAIMS

We claim:

1. A method for applying a back contact silver busbar to an aluminum back surface field (BSF) of a solar cell comprising:

(a) providing a solar cell substrate having a front side and a back side;

(b) printing a full aluminum backing layer on the back side of the solar cell substrate;

(c) drying the printed aluminum backing layer to yield a full aluminum layer;

(d) printing and drying a peeling paste on the full aluminum layer in areas where silver busbar is desired;

(e) printing and drying a front contact silver paste on the front side of the solar cell substrate to produce a front grid electrode;

(f) co-firing and cooling the front and back sides of the solar cell, wherein during firing the peeling paste wets excess aluminum powder in the aluminum layer, such that during cooling of the solar cell, the peeling paste contracts, solidifies, and peels off with the excess aluminum powder to leave a full aluminum BSF having open areas; and

(g) printing, drying, and firing a back contact silver paste on the open areas of the BSF to yield the silver busbar.

2. The method according to claim 1, wherein the solar cell substrate comprises monocrystalline or multicrystalline silicon.

3. The method according to claim 1, wherein the co-firing in step (f) is performed at a peak temperature of at least about 700-800°C.

4. The method according to claim 1, wherein the cooling in step (f) is performed at a rate of about 60 to 80°C per second.

5. The method according to claim 1, wherein the firing in step (g) is performed at about 500°C.

6. The method according to claim 1, wherein the peeling paste comprises:

(a) a powder system in an amount of 30-80% by weight of the paste and having a particle size of about 0.1 to 5.0 microns;

(b) a glass system in an amount of 3 to 20 % by weight of the paste and having a particle size of about 0.1 to 4.5 microns and a Tg of 300 to 800°C; and

(c) an organic system in an amount of 10-30% by weight of the paste.

7. The method according to claim 6, wherein the powder system comprises at least one component selected from the group consisting of a silver powder, a copper powder, and a metal oxide powder, wherein the metal oxide powder is one that binds with the aluminum powder and shrinks during firing.

8. The method according to claim 1, wherein the back contact silver paste fires at less than about 550°C.

9. The method according to claim 1, wherein the peeling paste comprises:

(a) at least one type of particles selected from the group consisting of silver particles, copper particles, and metal oxide particles, wherein the particles have a particle size of 0.1 to 5.0 microns;

(b) glass frit having a particle size of 0.1 to 4.5 microns and a Tg of 300 to 800°C; and

(c) an organic vehicle.

10. A solar cell formed by the method of claim 1.

11. The solar cell according to claim 10, wherein the co-firing in step (f) is performed at a peak temperature of at least about 700-800°C.

12. The solar cell according to claim 10, wherein the cooling in step (f) is performed at a rate of about 60 to 80°C per second.

13. The solar cell according to claim 10, wherein the firing in step (g) is performed at about 500°C.

14. The solar cell according to claim 10, wherein the peeling paste comprises:
(a) a powder system in an amount of 30-80% by weight of the paste and having a particle size of about 0.1 to 5.0 microns;

(b) a glass system in an amount of 3 to 20 % by weight of the paste and having a particle size of about 0.1 to 4.5 microns and a Tg of 300 to 800°C; and

(c) an organic system in an amount of 10-30% by weight of the paste.

15. The solar cell according to claim 10, wherein the back contact silver paste is fired at less than about 550°C.

16. The solar cell according to claim 10, wherein the peeling paste comprises:

(a) at least one type of particles selected from the group consisting of silver particles, copper particles, and metal oxide particles, wherein the particles have a particle size of 0.1 to 5.0 microns;

(b) glass frit having a particle size of 0.1 to 4.5 microns and a Tg of 300 to 800°C; and

(c) an organic vehicle.

CLAIMS

We claim:

1. A method for applying a back contact silver busbar to an aluminum back surface filed (BSF) of a solar cell comprising:

a. providing a solar cell substrate having a front side and a back side;

b. printing a full aluminum backing layer on the back side of the solar cell substrate;

c. drying the printed aluminum backing layer to yield a full aluminum layer;

d. printing and drying a peeling paste on the full aluminum layer in areas where silver busbar is desired:

e. printing and drying a front contact silver paste on the front side of the solar cell substrate to produce a front grid electrode;

f. co-firing and cooling the front and back sides of the solar cell, wherein during firing the peeling paste wets excess aluminum powder in the aluminum layer, such that during cooling of the solar cell, the peeling paste contracts, solidifies, and peels off with the excess aluminum powder to leave a full aluminum BSF having open areas; and

g. printing, drying, and firing a back contact silver paste on the open areas of the BSF to yield the silver busbar.

2. The method according to claim 1, wherein the solar cell substrate comprises monnocrystalline or multicrystalline silicon.

3. The method according to claim 1, wherein the co-firing step (f) is performed at a peak temperature of at least about 700-800 C.

4. The method according to claim 1, wherein the cooling in step (f) is performed at a rate of about 60 to 80 C per second.

5. The method according to claim 1, wherein the firing in step (g) is performed at about 500 C.

6. The method according to claim 1, wherein the peeling paste comprises:

a. a powder system in an amount of 30-80% by weight of the paste and having a particle size of about 0.1 to 5.0 microns;

b. a glass system in an amount of 3 to 20% by weight of the paste and having a particle size of about 0.1 to 4.5 microns and a Tg of 300 to 800 C; and

c. an organic system in an amount of 10-30% by weight of the paste.

7. The method according to claim 1, wherein the back contact silver paste fires at less than about 550 C.

8. The method according to claim 1, wherein the peeling paste comprises:

a. at least one type of the particles selected from the group consisting of silver particles, copper particles, and metal oxide particles, wherein the particles have a particle size of 0.1 to 5.0 microns;

b. glass frit having a particle size of 0.1 to 4.5 microns a Tg of 300 to 800 C; and

c. an organic vehicle.

9. Solar cell formed by the method of claim 1.

10. The solar cell according to claim 9, wherein the co-firing in step (f) is performed at a peak temperature of at least about 700-800 C.

11. The solar cell according to claim 9, wherein the cooling in step (f) is performed at a rate of about 60 to 80 C per second.

12. The solar cell according to claim 9, wherein the firing in step (g) is performed at about 500 C.

13. The solar cell according to claim 9, wherein the peeling paste comprises:

a. a powder system in an amount of 30-80% by weight of the paste and having a particle size of about 0.1 to 5.0 microns;

b. a glass system in an amount of 3 to 20% by weight of the paste and having a particle size of about 0.1 to 4.5 microns and a Tg of 300 to 800 C; and

c. an organic system in an amount of 10-30% by weight of the paste.

14. The solar cell according to claim 9, wherein the back contact silver paste is fired at less than about 550 C.

15. The solar cell according to claim 9. wherein the peeling paste comprises:

a. at least one type of particles selected from the group consisting of silver particles, copper particles, and metal oxide particles, wherein the particles have a particle size of 0.1 to 5.0 microns;

b. glass frit having a particle size of 0.1 to 4.5 microns and a Tg of 300 to 800 C; and

c. an organic vehicle.