

CLAIM LISTING OF CHALLENGED CLAIMS FOR U.S. PATENT NO. 11,824,136

Claim number	Equivalent claim number	Claim Element
1[p]		A solar cell, comprising:
1[a]		a semiconductor substrate,
1[b]		wherein a rear surface of the semiconductor substrate has a first texture structure, the first texture structure has a non-pyramid-shaped microstructure and includes two or more first substructures at least partially stacked on one another, a top surface of the first substructure is a polygonal plane, and a one-dimensional size of the top surface of the outermost first substructure is less than or equal to 45 μm ; and
1[c]		wherein a front surface of the semiconductor substrate has a second texture structure, the second texture structure includes a pyramid-shaped microstructure, the pyramid-shaped microstructure includes a top portion away from the front surface of the semiconductor substrate and a bottom portion close to the front surface of the semiconductor substrate, and
1[d]		in a direction away from the front surface and perpendicular to the front surface, a distance between the top portion and the bottom portion of the pyramid-shaped microstructure is less than or equal to 5 μm ;
1[e]		a first passivation layer located on the second texture structure of the front surface of the semiconductor substrate;
1[f]		a tunnel oxide layer located on the first texture structure of the rear surface of the semiconductor substrate;
1[g]		a doped conductive layer located on a surface of the tunnel oxide layer; and
1[h]		a second passivation layer located on a surface of the doped conductive layer.
2		The solar cell according to claim 1, wherein for the two or more first substructures at least partially stacked on one another, in the direction away from the rear surface and perpendicular to the rear surface, a distance between the top surface of the outermost first substructure and the top surface of the adjacent first substructure is equal to or less than 2 μm .
3		The solar cell according to claim 1, wherein a shape of the polygonal plane includes at least one of a diamond, a square, a trapezoid, a substantially diamond, a substantially square or a substantially trapezoid.

Claim number	Equivalent claim number	Claim Element
5		The solar cell according to claim 1, wherein the first texture structure further includes two or more adjacent second substructures that do not stacked on one another, and a one-dimensional size of a top surface of the second substructure away from the rear surface is less than or equal to 45 μm .
6		The solar cell according to claim 5, wherein the top surface of the second substructure is a polygonal plane.
7[p]		The solar cell according to claim 1, wherein
7[a]		the tunnel oxide layer includes at least one of a silicon oxide layer, an aluminum oxide layer, a silicon oxynitride layer, a molybdenum oxide layer or a hafnium oxide layer, and
7[b]		the tunnel oxide layer has a thickness ranging from 0.8 nm to 2 nm.
8[p]		The solar cell according to claim 1, wherein
8[a]		the second passivation layer includes at least one of a silicon nitride layer, a silicon oxide layer or a silicon oxynitride layer, and
8[b]		the second passivation layer has a thickness ranging from 70 nm to 120 nm.
9		The solar cell according to claim 1, wherein the first passivation layer includes at least one of a silicon oxide layer, a silicon nitride layer, an aluminum oxide layer or a silicon oxynitride layer.
10[p]		The solar cell according to claim 1, wherein
10[a]		the first passivation layer is a stacked passivation structure of an aluminum oxide layer and a silicon nitride layer,
10[b]		the aluminum oxide layer has a thickness ranging from 2 nm to 10 nm, and
10[c]		the silicon nitride layer has a thickness ranging from 50 nm to 110 nm.
11[p]		The solar cell according to claim 1, wherein
11[a]		the first passivation layer is a stacked passivation structure of an aluminum oxide layer, a silicon nitride layer and a silicon oxynitride layer sequentially stacked,
11[b]		the aluminum oxide layer has a thickness ranging from 2 nm to 10 nm,
11[c]		the silicon nitride layer has a thickness ranging from 40 nm to 80 nm, and
11[d]		the silicon oxynitride layer has a thickness ranging from 10 nm to 60 nm.
12[p]		The solar cell according to claim 1, wherein
12[a]		the semiconductor substrate is an N-type monocrystalline silicon substrate,
12[b]		the doped conductive layer is an N-type doped polycrystalline silicon layer, an N-type doped microcrystalline silicon layer or an N-type doped amorphous silicon layer, and

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12[c]		the doped conductive layer has a thickness ranging from 60 nm to 200 nm.
13[p]	1[p]	A photovoltaic module, comprising a plurality of solar cell strings, wherein each of the plurality of solar cell strings comprises solar cells, and at least one of the solar cells comprises:
13[a]	1[a]	a semiconductor substrate,
13[b]	1[b]	wherein a rear surface of the semiconductor substrate has a first texture structure, the first texture structure has a non-pyramid-shaped microstructure and includes two or more first substructures at least partially stacked on one another, a top surface of the first substructure is a polygonal plane, and a one-dimensional size of the top surface of the outermost first substructure is less than or equal to 45 μm ; and
13[c]	1[c]	wherein a front surface of the semiconductor substrate has a second texture structure, the second texture structure includes a pyramid-shaped microstructure, the pyramid-shaped microstructure includes a top portion away from the front surface of the semiconductor substrate and a bottom portion close to the front surface of the semiconductor substrate, and
13[d]	1[d]	in a direction away from the front surface and perpendicular to the front surface, a distance between the top portion and the bottom portion of the pyramid-shaped microstructure is less than or equal to 5 μm ;
13[e]	1[e]	a first passivation layer located on the second texture structure of the front surface of the semiconductor substrate;
13[f]	1[f]	a tunnel oxide layer located on the first texture structure of the rear surface of the semiconductor substrate;
13[g]	1[g]	a doped conductive layer located on a surface of the tunnel oxide layer; and
13[h]	1[h]	a second passivation layer located on a surface of the doped conductive layer.
14	2	The photovoltaic module according to claim 13, wherein for the two or more first substructures at least partially stacked on one another, in the direction away from the rear surface and perpendicular to the rear surface, a distance between the top surface of the outermost first substructure and the top surface of the adjacent first substructure is equal to or less than 2 μm .
15	3	The photovoltaic module according to claim 13, wherein a shape of the polygonal plane includes at least one of a diamond, a square, a trapezoid, a substantially diamond, a substantially square or a substantially trapezoid.

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17	5	The photovoltaic module according to claim 13, wherein the first texture structure further includes two or more adjacent second substructures that do not stacked on one another, and a one-dimensional size of a top surface of the second substructure away from the rear surface is less than or equal to 45 μm .
18	6	The photovoltaic module according to claim 17, wherein the top surface of the second substructure is a polygonal plane.
19[p]	7[p]	The photovoltaic module according to claim 13, wherein
19[a]	7[a]	the tunnel oxide layer includes at least one of a silicon oxide layer, an aluminum oxide layer, a silicon oxynitride layer, a molybdenum oxide layer or a hafnium oxide layer, and
19[b]	7[b]	the tunnel oxide layer has a thickness ranging from 0.8 nm to 2 nm.
20[p]	8[p]	The photovoltaic module according to claim 13, wherein
20[a]	8[a]	the second passivation layer includes at least one of a silicon nitride layer, a silicon oxide layer or a silicon oxynitride layer, and
20[b]	8[b]	the second passivation layer has a thickness ranging from 70 nm to 120 nm.