PREPARATION METHOD AND APPLICATION OF MONOCRYSTALLINE SILICON WAFER

TECHNICAL FIELD

This invention relates to a method for preparing a monocrystalline silicon wafer and an application thereof.

BACKGROUND

Quasi-square or square monocrystalline silicon wafers are prepared by slicing a monocrystalline silicon rod. Normally, the monocrystalline silicon rod is square-cut first to obtain a quasi-square or square monocrystalline silicon rod used for preparing quasi-square or square monocrystalline silicon wafers. Subsequently, the quasi-square or square monocrystalline silicon rod is sliced to obtain quasi-square or square monocrystalline silicon wafers.

When square-cutting the monocrystalline silicon rod, offcut material is inevitably generated. The offcut material is normally recycled or used as the seed of a highly-efficient polycrystalline silicon ingot, resulting in low utilization rate of the monocrystalline silicon rod.

SUMMARY

The purpose of the present invention is to provide a preparation method of a monocrystalline silicon wafer. By means of the preparation method, a monocrystalline silicon rod can be sliced into strip-shaped right-angle monocrystalline silicon wafers and quasi-square monocrystalline silicon wafers, or sliced into strip-shaped right-angle monocrystalline silicon wafers and square monocrystalline silicon wafers. Therefore, the utilization rate of the monocrystalline silicon rod is significantly improved.

To achieve the above purpose, the present invention adopts the following technical solution: a method for preparing a monocrystalline silicon wafer, used for preparing a strip-shaped right-angle monocrystalline silicon wafer and a quasi-square monocrystalline silicon wafer, or preparing a strip-shaped right-angle monocrystalline silicon wafer and a square monocrystalline silicon wafer, comprising the steps of:

Determining the length (a) and the width (b) of a strip-shaped right-angle monocrystalline silicon wafer, determining the side length (L) of a quasi-square or square monocrystalline silicon wafer, and making the width (b) of the strip-shaped right-angle monocrystalline silicon wafer smaller than the side length (L) of the quasi-square or square monocrystalline silicon wafer; determining the diameter (Φ) of a monocrystalline silicon rod, and making the side length (L) of the quasi-square or square monocrystalline silicon wafer smaller than the diameter (Φ) of the monocrystalline silicon rod; determining the length (H) of the monocrystalline silicon rod according to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer, thereby making the length (H) of the monocrystalline silicon rod greater than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; preparing a cylindrical monocrystalline silicon rod according to the determined diameter (Φ) and length (H) of the monocrystalline silicon rod;

Cutting off the two ends of the monocrystalline silicon rod, and making the length (h) of the residual section of the monocrystalline silicon rod not smaller than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; square-cutting the residual section of the monocrystalline silicon rod according to the determined side length (L) of the quasi-square or square monocrystalline silicon wafer, thereby obtaining a quasi-square monocrystalline silicon rod used for preparing quasi-square monocrystalline silicon wafers or a square monocrystalline silicon rod used for preparing square monocrystalline silicon wafers, and obtaining four pieces of offcut material, wherein the four pieces of offcut material are cut along the length direction of the residual section of the monocrystalline silicon rod, and the length of the four pieces of offcut material is equal to the length of the residual section of the monocrystalline silicon rod, wherein each piece of offcut material comprises a rectangular cutting surface formed by the square-cutting and an arc surface opposite to the cutting surface, wherein the cutting surface is a reference surface, and the positions where the cutting surface and the arc surface are joined form sharp corners;

Obtaining quasi-square monocrystalline silicon wafers by slicing the quasi-square

monocrystalline silicon rod, or obtaining square monocrystalline silicon wafers by slicing the square monocrystalline silicon rod;

Cutting each piece of offcut material according to the determined length (a) of the strip-shaped right-angle monocrystalline silicon wafer, wherein each piece of offcut material at least comprises a small section of the offcut material, and the length of the reference surface on each small section of offcut material is equal to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; cutting off the sharp corners on two sides of each small section of offcut material, thereby obtaining a monocrystalline silicon block used for preparing strip-shaped right-angle monocrystalline silicon wafers, and then making the length and width of the reference surface on the monocrystalline silicon block equal to the length and width of the strip-shaped right-angle monocrystalline silicon wafer; slicing the monocrystalline silicon block along a direction parallel to the reference surface on the monocrystalline silicon block, thereby obtaining strip-shaped right-angle monocrystalline silicon wafers.

In another preferred embodiment, the method for preparing the monocrystalline silicon wafer, comprising:

Taking the ratio value (L: b) of the side length (L) of a quasi-square monocrystalline silicon wafer to the width (b) of a strip-shaped right-angle monocrystalline silicon wafer as a first ratio value, and taking the ratio value (Φ: b) of the diameter (Φ) of a monocrystalline silicon rod to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer (b) as a second ratio value;

Determining the width (b) of the strip-shaped right-angle monocrystalline silicon wafer, wherein the first ratio value and the second ratio value are both greater than 1, and the first ratio value is smaller than the second ratio value;

Determining the side length (L) of the quasi-square or square monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the first ratio value;

Determining the diameter (Φ) of the monocrystalline silicon rod according to the width (b) of the strip-shaped right monocrystalline silicon wafer and the second ratio

value.

In another preferred embodiment, the method for preparing the monocrystalline silicon wafer, comprising: taking the ratio value (a: b) of the length (a) of the strip-shaped right-angle monocrystalline silicon wafer to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer as a third ratio value; determining the third ratio value, and determining the length (a) of the strip-shaped right-angle monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the third ratio value.

In another preferred embodiment, the method for preparing the monocrystalline silicon wafer, comprising: determining the first ratio value as well as the difference value between the first ratio value and the second ratio value first, and then determining the second ratio value according to the first ratio value and the difference value.

In another preferred embodiment, the method for preparing the monocrystalline silicon wafer, comprising: determining the second ratio value as well as the difference value between the first ratio value and the second ratio value first, and then determining the first ratio value according to the second ratio value and the difference value.

In another preferred embodiment, cutting off the two ends of a monocrystalline silicon rod is to respectively cut off a length of 5-100mm from the edges of the two ends of the monocrystalline silicon rod along the axial direction.

In another preferred embodiment, the width (b) of the strip-shaped right-angle monocrystalline silicon wafer is 12.5-200mm.

In another preferred embodiment, the thickness of the strip-shaped right-angle monocrystalline silicon wafer is 50-220um.

In another preferred embodiment, a solar cell module adopting the strip-shaped right-angle monocrystalline silicon wafers prepared through adopting the method of the present invention.

In another preferred embodiment, the solar cell module is prepared through adopting the imbricated technology and splicing technology.

Compared with the prior art, the present invention has the following advantages:

The present invention provides a preparation method of a monocrystalline silicon wafer. By means of the preparation method of the present invention, a monocrystalline silicon rod can be sliced into strip-shaped right-angle monocrystalline silicon wafers and quasi-square monocrystalline silicon wafers, or can be sliced into strip-shaped right-angle monocrystalline silicon wafers and square monocrystalline silicon wafers. Therefore, the utilization rate of the monocrystalline silicon rod is significantly improved.

According to the present invention, the side length (L) of the quasi-square or square monocrystalline silicon wafer can be determined according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer, and the diameter (Φ) of the monocrystalline silicon rod can be determined according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer as well. Namely, the size of the strip-shaped right-angle monocrystalline silicon wafer can be pre-determined, and the size of the quasi-square or square monocrystalline silicon wafer can be determined according to the size of the strip-shaped right-angle monocrystalline silicon wafer, which makes the size of a monocrystalline silicon rod suitable for preparing strip-shaped right-angle monocrystalline silicon wafers, quasi-square monocrystalline silicon wafers or square monocrystalline silicon wafers with specific sizes. The preparation method of the present invention allows monocrystalline silicon wafers with two specific sizes to be simultaneously prepared and achieves efficient utilization of the monocrystalline silicon rod.

Additionally, the present invention has the following technical features:

First, as the cell technology develops, the size of the silicon wafer becomes increasingly larger, and the shape of the silicon wafer tends to be square, meaning more and more offcut material is generated when square-cutting a cylindrical silicon rod, which results in low utilization rate of the silicon rod. Through adopting the method of the present invention, the offcut material is no longer recycled or used as the seed of a highly-efficient polycrystalline silicon ingot but is sliced into strip-shaped right-angle monocrystalline silicon wafers, which greatly improves the utilization rate of the silicon rod.

Second, the energy consumption is increased when the offcut material is directly remelted. Presently, the photovoltaic industry pays special attention to the energy consumption. By means of the present invention, the offcut material is further processed into strip-shaped right-angle monocrystalline silicon wafers, which greatly reduces the energy consumption.

Third, the cell pieces used in the existing imbricated and splicing technologies are all prepared by slicing and dividing the finished cells (e.g., quasi-square wafers or square wafers), which needs laser slicing equipment and extended working hours, resulting in high manufacturing cost of the cell module. By means of the present invention, the size of strip-shaped right-angle monocrystalline silicon wafers can be predetermined, which enables the strip-shaped right-angle monocrystalline silicon wafers with sizes suitable for imbricated and splicing technologies to be directly prepared. Through a matched cell production line, the cells (i.e., strip-shaped right-angle monocrystalline silicon cells) suitable for imbricated and splicing technologies can be directly prepared, making the slicing process for preparing cell modules unnecessary.

Fourth, as described above, the cell pieces used in the existing imbricated and splicing technologies are all prepared by slicing and dividing the finished cells (e.g., quasi-square wafers or square wafers). Slicing the finished cells into pieces by using laser equipment may cause mechanical damage to the cells, resulting in low electrical performance of the cells. The present invention enables the strip-shaped right-angle monocrystalline silicon wafers with sizes suitable for imbricated and splicing technologies to be directly prepared. Therefore, slicing and dividing the finished cells are avoided, which effectively protects the cells against mechanical damage and degraded electrical performance caused by laser slicing.

Fifth, according to the present invention, the size of the strip-shaped right-angle monocrystalline silicon wafer and the size of the quasi-square or square

monocrystalline silicon wafer can be predetermined. Thus, the electrical performance of the strip-shaped right-angle monocrystalline silicon wafer can be improved by controlling the size of the strip-shaped right-angle monocrystalline silicon wafer, and the electrical performance of the quasi-square or square monocrystalline silicon wafer can be improved by controlling the size of the quasi-square or square monocrystalline silicon wafer, thereby further improving the electrical performance of the cell module.

Sixth, the four corners of the strip-shaped right-angle monocrystalline silicon wafer prepared by means of the present invention are all right angles. After cells are prepared by using the aforesaid wafers, the light receiving area can be improved, and the generated power of the module can be increased.

Seventh, the preparation method of the monocrystalline silicon wafer of the present invention is suitable for both p-type monocrystalline silicon wafer and n-type monocrystalline silicon wafer.

DETAILED DESCRIPTION

Detailed embodiments are combined hereinafter to further elaborate the implementation of the present invention. The following embodiments are merely used to clearly describe the technical solutions of the present invention and are not intended to limit the scope of the present invention.

Embodiment 1

A method for preparing a monocrystalline silicon wafer, used for preparing a strip-shaped right-angle monocrystalline silicon wafer and a quasi-square monocrystalline silicon wafer, comprising the steps of:

Determining the length (a) and the width (b) of a strip-shaped right-angle monocrystalline silicon wafer, determining the side length (L) of a quasi-square monocrystalline silicon wafer, and making the width (b) of the strip-shaped right-angle monocrystalline silicon wafer smaller than the side length (L) of the quasi-square monocrystalline silicon wafer; determining the diameter (Φ) of a monocrystalline silicon rod, and making the side length (L) of the quasi-square monocrystalline silicon

wafer smaller than the diameter (Φ) of the monocrystalline silicon rod; determining the length (H) of the monocrystalline silicon rod according to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer, thereby making the length (H) of the monocrystalline silicon rod greater than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; preparing a cylindrical monocrystalline silicon rod according to the determined diameter (Φ) and length (H) of the monocrystalline silicon rod;

Cutting off the two ends of the monocrystalline silicon rod, and making the length (h) of the residual section of the monocrystalline silicon rod not smaller than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; square-cutting the residual section of the monocrystalline silicon rod according to the determined side length (L) of the quasi-square monocrystalline silicon wafer, thereby obtaining a quasi-square monocrystalline silicon rod used for preparing quasi-square monocrystalline silicon wafers and four pieces of offcut material, wherein the four pieces of offcut material are cut along the length direction of the residual section of the monocrystalline silicon rod, and the length of the four pieces of offcut material is equal to the length of the residual section of the monocrystalline silicon rod, wherein each piece of offcut material comprises a rectangular cutting surface formed by the square-cutting and an arc surface opposite to the cutting surface, wherein the cutting surface is a reference surface, and the positions where the cutting surface and the arc surface are joined form sharp corners;

Obtaining quasi-square monocrystalline silicon wafers by slicing the quasi-square monocrystalline silicon rod;

Cutting each piece of offcut material according to the determined length (a) of the strip-shaped right-angle monocrystalline silicon wafer, wherein each piece of offcut material at least comprises a small section of the offcut material, and the length of the reference surface on each small section of offcut material is equal to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; cutting off the sharp corners on two sides of each small section of offcut material, thereby obtaining a

monocrystalline silicon block used for preparing strip-shaped right-angle monocrystalline silicon wafers, and then making the length and width of the reference surface on the monocrystalline silicon block equal to the length and width of the strip-shaped right-angle monocrystalline silicon wafer; slicing the monocrystalline silicon block along a direction parallel to the reference surface on the monocrystalline silicon block, thereby obtaining strip-shaped right-angle monocrystalline silicon wafers.

Embodiment 2

A method for preparing a monocrystalline silicon wafer, used for preparing a strip-shaped right-angle monocrystalline silicon wafer and a square monocrystalline silicon wafer, comprising the steps of:

Determining the length (a) and the width (b) of a strip-shaped right-angle monocrystalline silicon wafer, determining the side length (L) of a square monocrystalline silicon wafer, and making the width (b) of the strip-shaped right-angle monocrystalline silicon wafer smaller than the side length (L) of the square monocrystalline silicon wafer; determining the diameter (Φ) of a monocrystalline silicon rod, and making the side length (L) of the square monocrystalline silicon wafer smaller than the diameter (Φ) of the monocrystalline silicon rod; determining the length (H) of the monocrystalline silicon rod according to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer, thereby making the length (H) of the monocrystalline silicon rod greater than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; preparing a cylindrical monocrystalline silicon rod according to the determined diameter (Φ) and length (H) of the monocrystalline silicon rod;

Cutting off the two ends of the monocrystalline silicon rod, and making the length (h) of the residual section of the monocrystalline silicon rod not smaller than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; square-cutting the residual section of the monocrystalline silicon rod according to the determined side length (L) of the square monocrystalline silicon wafer, thereby obtaining a square monocrystalline silicon rod used for preparing square monocrystalline silicon wafers

and four pieces of offcut material, wherein the four pieces of offcut material are cut along the length direction of the residual section of the monocrystalline silicon rod, and the length of the four pieces of offcut material is equal to the length of the residual section of the monocrystalline silicon rod, wherein each piece of offcut material comprises a rectangular cutting surface formed by the square-cutting process and an arc surface opposite to the cutting surface, wherein the cutting surface is a reference surface, and the positions where the cutting surface and the arc surface are joined form sharp corners;

Obtaining square monocrystalline silicon wafers by slicing the square monocrystalline silicon rod;

Cutting each piece of offcut material according to the determined length (a) of the strip-shaped right-angle monocrystalline silicon wafer, wherein each piece of offcut material at least comprises a small section of the offcut material, and the length of the reference surface on each small section of offcut material is equal to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; cutting off the sharp corners on two sides of each small section of offcut material, thereby obtaining a monocrystalline silicon block used for preparing strip-shaped right-angle monocrystalline silicon wafers, and then making the length and width of the reference surface on the monocrystalline silicon block equal to the length and width of the strip-shaped right-angle monocrystalline silicon wafer; slicing the monocrystalline silicon block along a direction parallel to the reference surface on the monocrystalline silicon block, thereby obtaining strip-shaped right-angle monocrystalline silicon wafers.

Embodiment 3

A method for preparing a monocrystalline silicon wafer, used for preparing a strip-shaped right-angle monocrystalline silicon wafer and a quasi-square monocrystalline silicon wafer, comprising the steps of:

Taking the ratio value (L: b) of the side length (L) of a quasi-square monocrystalline silicon wafer to the width (b) of a strip-shaped right-angle monocrystalline silicon wafer as a first ratio value;

Taking the ratio value (Φ: b) of the diameter (Φ) of a monocrystalline silicon rod to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer as a second ratio value;

Taking the ratio value (a: b) of the length (a) of the strip-shaped right-angle monocrystalline silicon wafer to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer as a third ratio value;

Determining the width (b) of the strip-shaped right-angle monocrystalline silicon wafer, and determining the first ratio value, the second ratio value and the third ratio value, wherein the first ratio value, the second ratio value and the third ratio value are all greater than 1, and the first ratio value is smaller than the second ratio value;

Determining the side length (L) of the quasi-square monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the first ratio value;

Determining the diameter (Φ) of the monocrystalline silicon rod according to the width (b) of the strip-shaped right monocrystalline silicon wafer and the second ratio value;

Determining the length (a) of the strip-shaped right-angle monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the third ratio value;

Determining the length (H) of the monocrystalline silicon rod according to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer, thereby enabling the length (H) of the monocrystalline silicon rod to be greater than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer;

Preparing a cylindrical monocrystalline silicon rod according to the determined diameter (Φ) and length (H) of the monocrystalline silicon rod;

Cutting off the two ends of the monocrystalline silicon rod, and making the length (h) of the residual section of the monocrystalline silicon rod not smaller than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; square-cutting the residual section of the monocrystalline silicon rod according to the determined side

length (L) of the quasi-square monocrystalline silicon wafer, thereby obtaining a quasi-square monocrystalline silicon rod used for preparing quasi-square monocrystalline silicon wafers and four pieces of offcut material, wherein the four pieces of offcut material are cut along the length direction of the residual section of the monocrystalline silicon rod, and the length of the four pieces of offcut material is equal to the length of the residual section of the monocrystalline silicon rod, wherein each piece of offcut material comprises a rectangular cutting surface formed by the square-cutting and an arc surface opposite to the cutting surface, wherein the cutting surface is a reference surface, and the positions where the cutting surface and the arc surface are joined form sharp corners;

Obtaining quasi-square monocrystalline silicon wafers by slicing the quasi-square monocrystalline silicon rod;

Cutting each piece of offcut material according to the determined length (a) of the strip-shaped right-angle monocrystalline silicon wafer, wherein each piece of offcut material at least comprises a small section of the offcut material, and the length of the reference surface on each small section of offcut material is equal to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; cutting off the sharp corners on two sides of each small section of offcut material, thereby obtaining a monocrystalline silicon block used for preparing strip-shaped right-angle monocrystalline silicon wafers, and then making the length and width of the reference surface on the monocrystalline silicon block equal to the length and width of the strip-shaped right-angle monocrystalline silicon wafer; slicing the monocrystalline silicon block along a direction parallel to the reference surface on the monocrystalline silicon block, thereby obtaining strip-shaped right-angle monocrystalline silicon wafers.

Embodiment 4

A method for preparing a monocrystalline silicon wafer, used for preparing a strip-shaped right-angle monocrystalline silicon wafer and a square monocrystalline silicon wafer, comprising the steps of:

Taking the ratio value (L: b) of the side length (L) of a square monocrystalline

silicon wafer to the width (b) of a strip-shaped right-angle monocrystalline silicon wafer as a first ratio value;

Taking the ratio value (Φ: b) of the diameter (Φ) of a monocrystalline silicon rod to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer as a second ratio value;

Taking the ratio value (a: b) of the length (a) of the strip-shaped right-angle monocrystalline silicon wafer to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer as a third ratio value;

Determining the width (b) of the strip-shaped right-angle monocrystalline silicon wafer, and determining the first ratio value, the second ratio value and the third ratio value, wherein the first ratio value, the second ratio value and the third ratio value are all greater than 1, and the first ratio value is smaller than the second ratio value;

Determining the side length (L) of the square monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the first ratio value;

Determining the diameter (Φ) of the monocrystalline silicon rod according to the width (b) of the strip-shaped right monocrystalline silicon wafer and the second ratio value;

Determining the length (a) of the strip-shaped right-angle monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the third ratio value;

Determining the length (H) of the monocrystalline silicon rod according to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer, thereby enabling the length (H) of the monocrystalline silicon rod to be greater than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer;

Preparing a cylindrical monocrystalline silicon rod according to the determined diameter (Φ) and length (H) of the monocrystalline silicon rod;

Cutting off the two ends of the monocrystalline silicon rod, and making the length (h) of the residual section of the monocrystalline silicon rod not smaller than the length

(a) of the strip-shaped right-angle monocrystalline silicon wafer; square-cutting the residual section of the monocrystalline silicon rod according to the determined side length (L) of the square monocrystalline silicon wafer, thereby obtaining a square monocrystalline silicon rod used for preparing square monocrystalline silicon wafers and four pieces of offcut material, wherein the four pieces of offcut material are cut along the length direction of the residual section of the monocrystalline silicon rod, and the length of the four pieces of offcut material is equal to the length of the residual section of the monocrystalline silicon rod, wherein each piece of offcut material comprises a rectangular cutting surface formed by the square-cutting process and an arc surface opposite to the cutting surface, wherein the cutting surface is a reference surface, and the positions where the cutting surface and the arc surface are joined form sharp corners;

Obtaining square monocrystalline silicon wafers by slicing the square monocrystalline silicon rod;

Cutting each piece of offcut material according to the determined length (a) of the strip-shaped right-angle monocrystalline silicon wafer, wherein each piece of offcut material at least comprises a small section of the offcut material, and the length of the reference surface on each small section of offcut material is equal to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; cutting off the sharp corners on two sides of each small section of offcut material, thereby obtaining a monocrystalline silicon block used for preparing strip-shaped right-angle monocrystalline silicon wafers, and then making the length and width of the reference surface on the monocrystalline silicon block equal to the length and width of the strip-shaped right-angle monocrystalline silicon wafer; slicing the monocrystalline silicon block along a direction parallel to the reference surface on the monocrystalline silicon block, thereby obtaining strip-shaped right-angle monocrystalline silicon wafers.

Embodiment 5

Based on embodiment 3 or 4, the difference of embodiment 5 lies in:

Determining the first ratio value as well as the difference value between the first

ratio value and the second ratio value first, and then determining the second ratio value according to the first ratio value and the difference value.

Embodiment 6

Based on embodiment 3 or 4, the difference of embodiment 6 lies in:

Determining the second ratio value as well as the difference value between the first ratio value and the second ratio value first, and then determining the first ratio value according to the second ratio value and the difference value.

In Embodiments 1-6:

More specifically, cutting off the two ends of a monocrystalline silicon rod is to respectively cut off a length of 5-100mm from the edges of the two ends of the monocrystalline silicon rod along the axial direction.

The width (b) of the strip-shaped right-angle monocrystalline silicon wafer is 12.5-200mm.

The thickness of the strip-shaped right-angle monocrystalline silicon wafer is 50-220um.

Embodiment 7

A solar cell module adopting the strip-shaped right-angle monocrystalline silicon wafers prepared in embodiments 1-6.

Embodiment 8

Based on embodiment 7, the difference of embodiment 8 lies in:

The solar cell module is prepared through adopting the imbricated technology or splicing technology.

The above are merely preferred embodiments of the present invention. It should be noted that various improvements and refinements may be made by those skilled in the art without departing from the principles of the present invention. Therefore, these improvements and refinements shall also fall into the scope of the present invention.

WHAT IS CLAIMED IS:

1. A preparation method for a monocrystalline silicon wafer, used for preparing a strip-shaped right-angle monocrystalline silicon wafer and a quasi-square monocrystalline silicon wafer, or preparing a strip-shaped right-angle monocrystalline silicon wafer and a square monocrystalline silicon wafer, comprising the steps of:

Determining the length (a) and the width (b) of a strip-shaped right-angle monocrystalline silicon wafer, determining the side length (L) of a quasi-square or square monocrystalline silicon wafer, and making the width (b) of the strip-shaped right-angle monocrystalline silicon wafer smaller than the side length (L) of the quasi-square or square monocrystalline silicon wafer; determining the diameter (Φ) of a monocrystalline silicon rod, and making the side length (L) of the quasi-square or square monocrystalline silicon wafer smaller than the diameter (Φ) of the monocrystalline silicon rod; determining the length (H) of the monocrystalline silicon rod according to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer, thereby making the length (H) of the monocrystalline silicon rod greater than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; preparing a cylindrical monocrystalline silicon rod according to the determined diameter (Φ) and length (H) of the monocrystalline silicon rod;

Cutting off the two ends of the monocrystalline silicon rod, and making the length (h) of the residual section of the monocrystalline silicon rod not smaller than the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; square-cutting the residual section of the monocrystalline silicon rod according to the determined side length (L) of the quasi-square or square monocrystalline silicon wafer, thereby obtaining a quasi-square monocrystalline silicon rod used for preparing quasi-square monocrystalline silicon wafers or a square monocrystalline silicon rod used for preparing square monocrystalline silicon wafers, and obtaining four pieces of offcut material, wherein the four pieces of offcut material are cut

along the length direction of the residual section of the monocrystalline silicon rod, and the length of the four pieces of offcut material is equal to the length of the residual section of the monocrystalline silicon rod, wherein each piece of offcut material comprises a rectangular cutting surface formed by the square-cutting and an arc surface opposite to the cutting surface, wherein the cutting surface is a reference surface, and the positions where the cutting surface and the arc surface are joined form sharp corners;

Obtaining quasi-square monocrystalline silicon wafers by slicing the quasi-square monocrystalline silicon rod, or obtaining square monocrystalline silicon wafers by slicing the square monocrystalline silicon rod;

Cutting each piece of offcut material according to the determined length (a) of the strip-shaped right-angle monocrystalline silicon wafer, wherein each piece of offcut material at least comprises a small section of the offcut material, and the length of the reference surface on each small section of offcut material is equal to the length (a) of the strip-shaped right-angle monocrystalline silicon wafer; cutting off the sharp corners on two sides of each small section of offcut material, thereby obtaining a monocrystalline silicon block used for preparing strip-shaped right-angle monocrystalline silicon wafers, and then making the length and width of the reference surface on the monocrystalline silicon block equal to the length and width of the strip-shaped right-angle monocrystalline silicon wafer; slicing the monocrystalline silicon block along a direction parallel to the reference surface on the monocrystalline silicon block, thereby obtaining strip-shaped right-angle monocrystalline silicon wafers.

2. The preparation method for a monocrystalline silicon wafer of claim 1, comprising:

Taking the ratio value (L: b) of the side length (L) of a quasi-square monocrystalline silicon wafer to the width (b) of a strip-shaped right-angle monocrystalline silicon wafer as a first ratio value, and taking the ratio value (Φ: b) of the diameter (Φ) of a monocrystalline silicon rod to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer (b) as a second ratio value;

Determining the width (b) of the strip-shaped right-angle monocrystalline silicon wafer, wherein the first ratio value and the second ratio value are both greater than 1, and the first ratio value is smaller than the second ratio value;

Determining the side length (L) of the quasi-square or square monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the first ratio value;

Determining the diameter (Φ) of the monocrystalline silicon rod according to the width (b) of the strip-shaped right monocrystalline silicon wafer and the second ratio value.

3. The preparation method for a monocrystalline silicon wafer of claim 2, comprising: taking the ratio value (a: b) of the length (a) of the strip-shaped right-angle monocrystalline silicon wafer to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer as a third ratio value; determining the third ratio value, and determining the length (a) of the strip-shaped right-angle monocrystalline silicon wafer according to the width (b) of the strip-shaped right-angle monocrystalline silicon wafer and the third ratio value.
4. The preparation method for a monocrystalline silicon wafer of claim 2 or 3, comprising: determining the first ratio value as well as the difference value between the first ratio value and the second ratio value first, and then determining the second ratio value according to the first ratio value and the difference value.
5. The preparation method for a monocrystalline silicon wafer of claim 2 or 3, comprising: determining the second ratio value as well as the difference value between the first ratio value and the second ratio value first, and then determining the first ratio value according to the second ratio value and the difference value.
6. The preparation method for a monocrystalline silicon wafer of claim1, wherein cutting off the two ends of a monocrystalline silicon rod is to respectively cut off a length of 5-100mm from the edges of the two ends of the monocrystalline silicon rod along the axial direction.
7. The preparation method for a monocrystalline silicon wafer of claim 1, wherein the

width (b) of the strip-shaped right-angle monocrystalline silicon wafer is 12.5-200mm.

8. The preparation method for a monocrystalline silicon wafer of claim 1, wherein the thickness of the strip-shaped right-angle monocrystalline silicon wafer is 50-220um.