[CLAIMS]

[Claim 1]

A quartz glass crucible comprising:

a cylindrical side wall portion;

a bottom portion;

a corner portion connecting the side wall portion and the bottom portion to each other;

a transparent layer made of quartz glass that does not contain bubbles;

a bubble layer formed outside the transparent layer and made of quartz glass containing a large number of bubbles; and

a semi-molten layer formed outside the bubble layer and made of raw material silica powder solidified in a semi-molten state,

wherein a thickness of the bubble layer in the cylindrical side wall portion is larger than that of the transparent layer in the cylindrical side wall portion,

a thickness of the bubble layer in the corner portion is larger than that of the transparent layer in the cylindrical side wall portion,

an infrared transmissivity of the corner portion in a state where the semi-molten layer is removed is 25 to 51%,

the infrared transmissivity of the corner portion in the state where the semi-molten layer is removed is lower than an infrared transmissivity of the side wall portion in a state where the semi-molten layer is removed, and

the infrared transmissivity of the corner portion in the state where the semi-molten layer is removed is lower than an infrared transmissivity of the bottom portion in a state where the semi-molten layer is removed.

[Claim 2]

The quartz glass crucible according to claim 1,

wherein the infrared transmissivity of the side wall portion in the state where the semi-molten layer is removed is higher than the infrared transmissivity of the bottom portion in the state where the semi-molten layer is removed.

[Claim 3]

The quartz glass crucible according to claim 1 or 2,

wherein the infrared transmissivity of the side wall portion in the state where the semi-molten layer is removed is 46 to 84%, and

the infrared transmissivity of the bottom portion in the state where the semi-molten layer is removed is 36 to 70%.

[Claim 4]

The quartz glass crucible according to any one of claims 1 to 3,

wherein a thermal conductivity of the corner portion in the state where the semi-molten layer is removed is 1.5×10^{-3} to 5.8×10^{-3} cal/cm·s·°C,

the thermal conductivity of the corner portion in the state where the semi-molten layer is removed is lower than a thermal conductivity of the side wall portion in the state where the semi-molten layer is removed, and

the thermal conductivity of the corner portion in the state where the semi-molten layer is removed is lower than a thermal conductivity of the bottom portion in the state where the semi-molten layer is removed.

[Claim 5]

The quartz glass crucible according to claim 4,

wherein the thermal conductivity of the side wall portion in the state where the semi-molten layer is removed is 3.5×10^{-3} to 15.0×10^{-3} cal/cm·s·°C, and
the thermal conductivity of the bottom portion in the state where the semi-molten layer is removed is 2.7×10^{-3} to 13.2×10^{-3} cal/cm·s·°C.

[Claim 6]
The quartz glass crucible according to any one of claims 1 to 5,
wherein a thickness of the bubble layer of the corner portion is 10 to 35 mm,
a thickness of the bubble layer of the side wall portion is 1 to 21 mm, and
a thickness of the bubble layer of the bottom portion is 4 to 21 mm.

[Claim 7]
A manufacturing method of a silicon single crystal by a Czochralski method, comprising:
pulling up a silicon single crystal having an oxygen concentration of 12×10^{17} atoms/cm^3 or less using the quartz glass crucible according to any one of claims 1 to 6.

[Claim 8]
A quartz glass crucible comprising:
a cylindrical side wall portion;
a bottom portion;
a corner portion connecting the side wall portion and the bottom portion to each other;
a transparent layer made of quartz glass that does not contain bubbles;
a bubble layer formed outside the transparent layer and made of quartz glass containing a large number of bubbles;

a semi-molten layer formed outside the bubble layer and made of raw material silica powder solidified in a semi-molten state; and

at least one semi-molten layer-removed portion formed of a region from which a portio n of the semi-molten layer has been removed,

wherein semi-molten layer-removed portion is a region from which the semi-molt en layer is locally removed, and the semi molten layer removed portion is surr ounded by the semi-molten layer.

[Claim 9]

The quartz glass crucible according to claim 8,

wherein the semi-molten layer-removed portion includes a first semi-molten layer-removed portion provided in the side wall portion, a second semi-molten layer-removed portion provided in the corner portion, and a third semi-molten layer-removed portion provided in the bottom portion.

~~[Claim 10]~~

~~An infrared transmissivity measurement method of a quartz glass crucible,~~

~~in which the quartz glass crucible includes~~

~~a transparent layer made of quartz glass that does not contain bubbles,~~

~~a bubble layer formed outside the transparent layer and made of quartz glass containing a large number of bubbles, and~~

~~a semi-molten layer formed outside the bubble layer and made of raw material silica powder solidified in a semi-molten state,~~

~~the infrared transmissivity measurement method comprising:~~

~~a step of processing an outer surface of the quartz glass crucible formed by the~~

~~semi-molten layer so that a surface roughness of the outer surface becomes low; and~~

~~a step of measuring an infrared transmissivity of the quartz glass crucible based on infrared light passing through the outer surface after processing the outer surface.~~

~~[Claim 11]~~

~~The infrared transmissivity measurement method of a quartz glass crucible according to claim 10,~~

~~wherein, in the step of processing the outer surface, the outer surface is processed so that an arithmetic average roughness Ra of the outer surface becomes 15 μm or less.~~

~~[Claim 12]~~

~~The infrared transmissivity measurement method of a quartz glass crucible according to claim 10 or 11,~~

~~wherein the outer surface is processed until the semi-molten layer is removed.~~

~~[Claim 13]~~

~~The infrared transmissivity measurement method of a quartz glass crucible according to any one of claims 10 to 12,~~

~~wherein the infrared transmissivity is measured using a crucible piece cut out from the quartz glass crucible.~~

~~[Claim 14]~~

~~The infrared transmissivity measurement method of a quartz glass crucible according to any one of claims 10 to 13,~~

~~wherein the step of processing the outer surface is a polishing treatment or a blasting~~

~~treatment.~~

~~[Claim 15]~~

~~A manufacturing method of a quartz glass crucible,~~

~~in which the quartz glass crucible includes~~

~~a transparent layer made of quartz glass that does not contain bubbles,~~

~~a bubble layer formed outside the transparent layer and made of quartz glass containing a large number of bubbles, and~~

~~a semi-molten layer formed outside the bubble layer and made of raw material silica powder solidified in a semi-molten state,~~

~~the manufacturing method comprising:~~

~~a step of manufacturing a first quartz glass crucible based on first manufacturing conditions;~~

~~a step of processing an outer surface of the first quartz glass crucible formed by the semi-molten layer so that a surface roughness of the outer surface becomes low;~~

~~a step of measuring an infrared transmissivity of the first quartz glass crucible based on infrared light passing through the outer surface after processing the outer surface; and~~

~~a step of manufacturing a second quartz glass crucible based on second manufacturing conditions modified based on a measurement result of the infrared transmissivity of the first quartz glass crucible so that a measured value of the infrared transmissivity becomes a target value.~~