~~Method for producing a coated component of quartz glass~~

Description

The present invention relates to method for producing a coated component of quartz glass in that a base body of quartz glass is provided that has a coating surface onto which a SiO_2 slurry layer is applied by spraying a SiO_2 slurry thereon, drying the slurry layer to obtain a green body layer, and sintering the green body layer to obtain a SiO_2-containing functional layer.

Prior art

Components of quartz glass are used for many applications, e.g. in lamp manufacture as cladding tubes, bulbs, cover plates, or reflector carriers for lamps and radiators in the ultraviolet, infrared and visible spectral range, in chemical apparatus engineering or in semiconductor production in the form of reactors and apparatus of quartz glass for the treatment of semiconductor components, trays, bell jars, crucibles, protective shields or simple quartz-glass components, such as tubes, rods, plates, flanges, rings or blocks.

For setting special surface properties or for improving the given mechanical, optical or chemical surface properties, the surface of the component is often modified in that the previously produced quartz glass component is provided completely or partially with a functional layer adapted to the specific purpose. Examples thereof are the improvement of the service life by a coating showing a higher softening temperature or better chemical resistance, a reduction of the contamination risk posed by the component by way of a coating consisting of a high-purity material, and a change in the heat insulation or reflectivity by transparent or opaque surfaces layers.

A method of the aforementioned type is known from DE 2004 051 846 A1. The publication describes the manufacture of a quartz glass component provided with

Patent claims

1. A method for producing a coated component of quartz glass in that a base body of quartz glass is provided that has a coating surface onto which a SiO_2 slurry layer is applied by spraying a SiO_2 slurry thereon, drying the slurry layer to obtain a green body layer, and sintering the green body layer to obtain a SiO_2-containing functional layer, wherein the slurry contains the following components in a dispersion liquid:

   (a) splintery amorphous SiO_2 granules with a grain size distribution having a D_{50} value in the range between 3 µm and 30 µm, with a weight fraction of at least 10% by wt., based on the total solids content,

   (b) spherical amorphous SiO_2 particles with a particle size distribution with a D_{50} value in the range between 1 µm and 50 µm, with a weight fraction of at least 30% by wt., based on the total solids content,

   (c) SiO_2 nanoparticles with particle sizes of less than 100 nm with a weight fraction between 0.2% by wt. and 10% by wt., based on the total solids content,

   (d) a non-ionic, alkali-free surfactant with a fraction in the range of from 0.005% to 0.5%, based on the volume of the dispersion liquid.

2. The method according to claim 1, characterized in that the splintery amorphous SiO_2 granules are present with a weight fraction in the range of 20% by wt. to 60% by wt., based on the total solids content.

3. The method according to claim 1 or 2, characterized in that the splintery amorphous SiO_2 granules have a grain size distribution with a D_{50} value in the range between 5 µm and 20 µm.

4. The method according to any one of the preceding claims, characterized in that the spherical amorphous SiO_2 granules are present with a weight fraction in the range of 40% by wt. to 80% by wt., based on the total solids content.

5. The method according to any one of the preceding claims, characterized in that the spherical amorphous SiO_2 granules have a grain size distribution with a D_{50} value in the range between 5 µm and 40 µm.

6. The method according to any one of the preceding method claims, characterized in that the SiO_2 nanoparticles are present with a weight fraction in the range of 3% by wt. to 8% by wt., based on the total solids content.

7. The method according to any one of the preceding claims, characterized in that the surfactant is present with a fraction in the range of 0.005% to 0.05%, based on the volume of the dispersion liquid.

8. The method according to any one of the preceding claims, characterized in that a mixture of water and an organic solvent with a low boiling temperature, preferably an alcohol, is used as the dispersion liquid.

9. The method according to any one of the preceding claims, characterized in that the solids content of the SiO_2 slurry is in the range between 70-80% by wt., preferably between 74-78% by wt.

10. The method according to any one of the preceding method claims, characterized in that a plurality of successive layers of the SiO_2 slurry layer are applied for producing the functional layer.

11. The method according to claim 10, characterized in that neighboring layers have different compositions.

12. The method according to any one of the preceding method claims, characterized in that the functional layer is produced with a layer thickness in the range between 0.1 mm and 4 mm.

METHOD FOR PRODUCING A COATED QUARTZ GLASS COMPONENT

Description

The present invention relates to method for producing a coated component of quartz glass in that a base body of quartz glass is provided that has a coating surface onto which a SiO_2 slurry layer is applied by spraying a SiO_2 slurry thereon, drying the slurry layer to obtain a green body layer, and sintering the green body layer to obtain a SiO_2-containing functional layer.

Prior art

Components of quartz glass are used for many applications, e.g. in lamp manufacture as cladding tubes, bulbs, cover plates, or reflector carriers for lamps and radiators in the ultraviolet, infrared and visible spectral range, in chemical apparatus engineering or in semiconductor production in the form of reactors and apparatus of quartz glass for the treatment of semiconductor components, trays, bell jars, crucibles, protective shields or simple quartz-glass components, such as tubes, rods, plates, flanges, rings or blocks.

For setting special surface properties or for improving the given mechanical, optical or chemical surface properties, the surface of the component is often modified in that the previously produced quartz glass component is provided completely or partially with a functional layer adapted to the specific purpose. Examples thereof are the improvement of the service life by a coating showing a higher softening temperature or better chemical resistance, a reduction of the contamination risk posed by the component by way of a coating consisting of a high-purity material, and a change in the heat insulation or reflectivity by transparent or opaque surfaces layers.

A method of the aforementioned type is known from DE 2004 051 846 A1. The publication describes the manufacture of a quartz glass component provided with

CLAIMS

1. A method for producing a coated component of quartz glass,
said method comprising:
providing a base body of quartz glass that has a coating surface;
applying onto said coating surface a SiO_2 slurry layer by spraying a SiO_2 slurry thereon;
drying the slurry layer so as to obtain a green body layer, and
sintering the green body layer so as to obtain a SiO_2 containing functional layer,
wherein the slurry contains the following components in a dispersion liquid:
(a) splintery amorphous SiO_2 granules with a grain size distribution having a D_{50} value in a range between 3μm and 30 μm,
wherein the splintery amorphous SiO_2 granules are present with a weight fraction in a range of 20% by wt. to 60% by wt., based on the total solids content,
(b) spherical amorphous SiO_2 particles with a particle size distribution with a D_{50} value in a range between 1 μm and 50 μm, with a weight fraction of at least 30% by wt., based on the total solids content,
(c) SiO_2 nanoparticles with particle sizes of less than 100 nm with a weight fraction between 0.2% by wt. and 10% by wt., based on the total solids content,
(d) a non-ionic, alkali-free surfactant with a fraction in a range from 0.005% to 0.5%, based on the volume of the dispersion liquid.

2. The method according to claim 1, wherein the spherical amorphous SiO_2 granules are present with a weight fraction in a range of 40% by wt. to 80% by wt., based on the total solids content.

3. The method according to claim 1, wherein the spherical amorphous SiO_2 granules have a grain size distribution with a D_{50} value in a range between 5 μm and 40 μm.

4. The method according to claim 1, wherein the SiO_2 nanoparticles are present with a weight fraction in a range of 3% by wt. to 8% by wt., based on the total solids content.

5. The method according to claim 1, wherein the surfactant is present with a fraction in a range of 0.005% to 0.05%, based on the volume of the dispersion liquid.

6. The method according to claim 1, wherein the dispersion liquid is a mixture of water and an organic solvent with a boiling temperature lower than that of water.

7. The method according to claim 1, wherein the solids content of the SiO_2 slurry is in a range between 70-80% by wt.

8. The method according to claim 1, wherein a plurality of successive layers of the SiO_2 slurry layer are applied so as to produce the functional layer.

9. The method according to claim 8, wherein neighboring layers have different compositions.

10. The method according to claim 1, wherein the functional layer is produced with a layer thickness in the range between 0.1 mm and 4 mm.

11. The method according to claim 1, wherein the dispersion liquid is a mixture of water and an alcohol with a boiling temperature lower than that of water.

12. The method according to claim 1, wherein the solids content of the SiO_2 slurry is in a range between 74-78% by wt.

13. The method according to claim 1, wherein the splintery amorphous SiO_2 granules have a grain size distribution with a D_{50} value in a range between 5 μm and 20 μm.

14. The method according to claim 13, wherein the spherical amorphous SiO_2 granules are present with a weight fraction in a range of 40% by wt. to 80% by wt., based on the total solids content.

15. The method according to claim 14, wherein the spherical SiO_2 amorphous SiO_2 granules have a grain size distribution with a D_{50} value in a range between 5 μm and 40 μm.

16. The method according to claim 15, wherein the SiO_2 nanoparticles are present with a weight fraction in a range of 3% by wt. to 8% by wt., based on the total solids content.

17. The method according to claim 16, wherein the surfactant is present with a fraction in a range of 0.005% to 0.05%, based on the volume of the dispersion liquid.

18. The method according to claim 17, wherein a plurality of successive layers of the SiO_2 slurry layer are applied so as to produce the functional layer.