Patent Claims

1. A method for producing a composite body from a basic body of opaque quartz glass and a dense sealing layer, the method comprising the following steps:

   (a) producing the basic body by using a first slip which contains a first dispersion liquid and first amorphous SiO_2 particles having particle sizes of not more than 500 µm, particles with particle sizes in the range between 1 µm and 60 µm accounting for the largest solids volume fraction, which contains a first quantitative amount of SiO_2 nanoparticles with particle sizes of less than 100 nm, and which is distinguished by a first higher vitrification temperature;

   (b) providing a second slip which contains a second dispersion liquid and second amorphous SiO_2 particles having particle sizes of not more than 100 µm, particles with particle sizes in the range between 1 µm and 40 µm accounting for the largest solids volume fraction, and the composition of which differs from that of the first slip at least in that it contains a second quantitative amount of SiO_2 nanoparticles which in the range between 0.2% by wt. to 15% by wt. is greater than the first quantitative amount (based each time on the total solids content), and which is distinguished by a second lower vitrification temperature;

   (c) producing a slip layer from the second slip on a surface of the basic body, drying the slip layer,

   (d) and subsequently vitrifying the slip layer with formation of the dense sealing layer.

2. The method according to claim 1, characterized in that the second slip contains between 0.5% by wt. and 8% by wt., and particularly preferably between 1% by wt. and 4% by wt., of SiO_2 nanoparticles (based on the total solids content).

3. The method according to claim 1 or 2, characterized in that in the second slip amorphous SiO_2 particles with particle sizes in the range between 1 µm and 30 µm account for the largest solids volume fraction.

4. The method according to any one of the preceding claims, characterized in that the amorphous SiO_2 particles of the second slip have a particle size distribution which is distinguished by a D_{50} value of less than 40 µm, preferably less than 30 µm, and particularly preferably less than 15 µm.

5. The method according to claim 4, characterized in that the amorphous SiO_2 particles of the first slip have a particle size distribution which is distinguished by a D_{50} value greater than the D_{50} value of the particle size distribution in the second slip.

6. The method according to any one of the preceding claims, characterized in that the second amorphous SiO_2 particles have a multimodal particle size distribution, with a first maximum of the size distribution (D_{50} value) in the range of 0.5 µm to 3 µm, preferably 1 µm to 3 µm, and with a second maximum in the range of 5 µm to 40 µm, preferably 5 µm to 15 µm.

7. The method according to any one of the preceding claims, characterized in that at least 90% by wt. of the amorphous SiO_2 particles of the second slip are made spherical.

8. The method according to any one of the preceding claims, characterized in that at least 50% by wt. of the amorphous SiO_2 particles of the first slip are produced by wet grinding SiO_2 start granules and are present in splintery form.

9. The method according to any one of the preceding claims, characterized in that during production of the slip layer the solids content of the second slip (weight amount of the SiO_2 particles and the SiO_2 nanoparticles together) is in the range between 80% and 90%, and preferably at least 83% by wt.

10. The method according to any one of the preceding claims, characterized in that the second amorphous SiO_2 particles and the SiO_2 nanoparticles consist of synthetic SiO_2.

11. The method according to any one of the preceding claims, characterized in that the second dispersion liquid is based on an organic solvent, preferably on alcohol.

12. The method according to any one of the preceding claims, characterized in that the SiO_2 content of the first and the second amorphous SiO_2 particles is at least 99.9% by wt.

13. The method according to any one of the preceding claims, characterized in that the difference between first and second vitrification temperature is at least 40°C, preferably at least 60°C.

14. The method according to any one of the preceding claims, characterized in that the dried slip layer is vitrified according to method step (d) by heating to a temperature ranging between 1000°C and 1460°C, preferably between 1200°C and 1440°C.

15. The method according to any one of the preceding claims, characterized in that the basic body is present as a porous green body during formation of the slip layer.

16. The method according to any one of claims 1 to 14, characterized in that a basic body of opaque quartz glass is present in the formation of the slip layer.

17. The method according to any one of the preceding claims, characterized in that the transparent sealing layer is formed in successive order by repeating method steps (b) and (c) of claim 1, the particle size distribution of the respectively used second slip being more and more shifted towards a lower D_{50} value.

18. The method according to claim 17, characterized in that method step (c) is each time followed by vitrification according to method step (d).

19. The method according to any one of the preceding claims, characterized in that an opaque intermediate layer of synthetic quartz glass with high reflection in the UV wavelength range is produced between the basic body and the sealing layer.

20. The method according to any one of the preceding claims, characterized in that a dopant which increases the etch resistance of quartz glass is added to the second slip.

21. The method according to any one of the preceding claims, characterized in that the composite body is used as a diffusely reflecting reflector.

22. The method according to any one of the preceding claims, characterized in that the first slip has added thereto a dopant counteracting vitrification into transparent quartz glass.

23. The method according to claim 22, characterized in that the dopant is present in nanoscale form and is selected from the group consisting of Si_3N_4, SiC and AlN.

24. The method according to any one of the preceding claims, characterized in that a plate-shaped basic body is used and provided with the sealing layer.

25. The method according to claim 24, characterized in that the composite body which is provided with the sealing layer has a plane surface and is elongated in a direction in parallel with the plane surface.

Patent Claims

1. A method for producing a composite body from a basic body of opaque quartz glass and a dense sealing layer, the method comprising the following steps:

(a) producing the basic body by using a first slip which contains a first dispersion liquid and first amorphous SiO_2 particles having particle sizes of not more than 500 µm, particles with particle sizes in the range between 1 µm and 60 µm accounting for the largest solids volume fraction, which contains a first quantitative amount of SiO_2 nanoparticles with particle sizes of less than 100 nm, and which is distinguished by a first higher vitrification temperature;

(b) providing a second slip which contains a second dispersion liquid and second amorphous SiO_2 particles having particle sizes of not more than 100 µm, particles with particle sizes in the range between 1 µm and 40 µm accounting for the largest solids volume fraction, and the composition of which differs from that of the first slip at least in that it contains a second quantitative amount of SiO_2 nanoparticles which in the range between 0.2% by wt. to 15% by wt. is greater than the first quantitative amount (based each time on the total solids content), and which is distinguished by a second lower vitrification temperature;

(c) producing a slip layer from the second slip on a surface of the basic body, drying the slip layer,

(d) and subsequently vitrifying the slip layer with formation of the dense sealing layer.

2. The method according to claim 1, characterized in that the second slip contains between 0.5% by wt. and 8% by wt., and particularly preferably between 1% by wt. and 4% by wt., of SiO_2 nanoparticles (based on the total solids content).

3. The method according to claim 1 or 2, characterized in that in the second slip amorphous SiO_2 particles with particle sizes in the range between 1 µm and 30 µm account for the largest solids volume fraction.

4. The method according to any one of the preceding claims, characterized in that the amorphous SiO_2 particles of the second slip have a particle size distribution which is distinguished by a D_{50} value of less than 40 µm, preferably less than 30 µm, and particularly preferably less than 15 µm.

5. The method according to claim 4, characterized in that the amorphous SiO_2 particles of the first slip have a particle size distribution which is distinguished by a D_{50} value greater than the D_{50} value of the particle size distribution in the second slip.

6. The method according to any one of the preceding claims, characterized in that the second amorphous SiO_2 particles have a multimodal particle size distribution, with a first maximum of the size distribution (D_{50} value) in the range of 0.5 µm to 3 µm, preferably 1 µm to 3 µm, and with a second maximum in the range of 5 µm to 40 µm, preferably 5 µm to 15 µm.

7. The method according to any one of the preceding claims, characterized in that at least 90% by wt. of the amorphous SiO_2 particles of the second slip are made spherical.

8. The method according to any one of the preceding claims, characterized in that at least 50% by wt. of the amorphous SiO_2 particles of the first slip are produced by wet grinding SiO_2 start granules and are present in splintery form.

9. The method according to any one of the preceding claims, characterized in that during production of the slip layer the solids content of the second slip (weight amount of the SiO_2 particles and the SiO_2 nanoparticles together) is in the range between 80% and 90%, and preferably at least 83% by wt.

10. The method according to any one of the preceding claims, characterized in that the second amorphous SiO_2 particles and the SiO_2 nanoparticles consist of synthetic SiO_2.

11. The method according to any one of the preceding claims, characterized in that the second dispersion liquid is based on an organic solvent, preferably on alcohol.

12. The method according to any one of the preceding claims, characterized in that the SiO_2 content of the first and the second amorphous SiO_2 particles is at least 99.9% by wt.

13. The method according to any one of the preceding claims, characterized in that the difference between first and second vitrification temperature is at least 40°C, preferably at least 60°C.

14. The method according to any one of the preceding claims, characterized in that the dried slip layer is vitrified according to method step (d) by heating to a temperature ranging between 1000°C and 1460°C, preferably between 1200°C and 1440°C.

15. The method according to any one of the preceding claims, characterized in that the basic body is present as a porous green body during formation of the slip layer.

16. The method according to any one of claims 1 to 14, characterized in that a basic body of opaque quartz glass is present in the formation of the slip layer.

17. The method according to any one of the preceding claims, characterized in that the transparent sealing layer is formed in successive order by repeating method steps (b) and (c) of claim 1, the particle size distribution of the respectively used second slip being more and more shifted towards a lower D_{50} value.

18. The method according to claim 17, characterized in that method step (c) is each time followed by vitrification according to method step (d).

19. The method according to any one of the preceding claims, characterized in that the composite body is used as a diffusely reflecting reflector.

20. The method according to claim 1, characterized in that the dopant is present in nanoscale form and is selected from the group consisting of Si_3N_4, SiC and AlN.

21. The method according to any one of the preceding claims, characterized in that a plate-shaped basic body is used and provided with the sealing layer.

22. The method according to claim 21, characterized in that the composite body which is provided with the sealing layer has a plane surface and is elongated in a direction in parallel with the plane surface.