Claims

1. A method for bonding of a first solid substrate (1) to a second solid substrate (2) which contains a first material with the following steps, especially the following sequence:
- formation or application of a function layer (5) which contains a second material to the second solid substrate (2),
- making contact of the first solid substrate (1) with the second solid substrate (2) on the function layer (5),
- pressing together the solid substrates (1, 2) for forming a permanent bond between the first and second solid substrate (1, 2), at least partially reinforced by solid diffusion and/or phase transformation of the first material with the second material, an increase of volume on the function layer being caused,

wherein the function layer (5) is formed or applied on a surface (4o) of the second solid substrate (2) in an average thickness (R) between 0,1 nm and 25 nm, and

wherein gaps present due to unevenness of the surface (4o) are closed by expansion of the volume of a contact surface formed by the function layer.

2. The method as claimed in Claim 1, wherein formation and/or reinforcement of the permanent bond by diffusion of the second material into the first material takes place, especially with formation of a mixed material.

3. The method as claimed in one of the preceding claims, wherein the formation of the permanent bond takes place at a temperature between room temperature and 500°C, especially between room temperature and 200°C, preferably between room temperature and 150°C, even more preferably between room temperature and 100°C, most preferably between room temperature and 50°C, especially during a maximum 12 days, preferably a maximum 1 day, even more preferably a maximum 1 hour, at best a maximum 15 minutes.

4. The method as claimed in one of the preceding claims, wherein the step of pressing together the solid substrates (1, 2) comprises pressing together the solid substrates (1, 2) to form a permanent bond ~~the permanent bond has~~ having a bond strength of greater than 1.5 J/m^2, especially greater than 2 J/m^2, preferably greater than 2.5 J/m^2.

5. The method as claimed in one of the preceding claims, wherein during solid diffusion and/or phase transformation a mixed material (C) with a greater molar volume than the molar volume of the second material and of first material is formed.

6. The method as claimed in one of the preceding claims, wherein prior to and/or after application/formation of the function layer plasma activation of the surfaces of the solid substrates takes place.

7. The method as claimed in one of the preceding claims, wherein the step of pressing together the solid substrates (1,2) comprises pressing together the solid substrates (1, 2) to form a permanent bond between the first and second solid substrate (1, 2), at least partially reinforced by solid diffusion and/or phase transformation of the first material with the second material ~~the solid diffusion and/or phase transformation is limited to~~ which forms a first surface layer (3) of the first solid substrate (1) ~~with~~ having a maximum initial thickness D smaller than 1 μm, especially smaller than 100 nm, preferably smaller than 10 nm, even more preferably smaller than 1 nm.

8. The method as claimed in one of the preceding claims, wherein the pressing together takes place at a pressure between 0.1 and 10 MPa.

9. The method as claimed in Claim 8, wherein the function layer (5) before formation of the permanent bond has an average thickness R between 1 angstrom and 10 nm.

10. The method as claimed in one of the preceding claims, wherein the solubility boundary of the first material for the second material during formation of the permanent bond is exceeded at least only slightly, especially at no site of solid diffusion and/or phase transformation.

11. The method as claimed in one of the preceding claims, wherein the solid diffusion take place at least predominantly as grain boundary diffusion.