Claims

1. A method for bonding of a first contact surface (3) of a first substrate (1) to a second contact surface (4) of a second substrate (2), the method comprising the steps of:

- forming a reservoir (5) in a surface layer (6) on the first contact surface (3), the surface layer (6) consisting at least largely of a native oxide material,
- at least partial filling of the reservoir (5) with a first educt or a first group of educts,
- bringing the first contact surface (3) in contact with the second contact surface (4) for formation of a prebond connection,
- forming a permanent bond between the first and second contact surface (3, 4), at least partially strengthened by the reaction of the first educt with a second educt contained in a reaction layer (7) of the second substrate (2).

2. The method as claimed in Claim 1, wherein formation and/or strengthening of the permanent bond takes place by diffusion of the first educt into the reaction layer (7).

3. The method as claimed in claim 1 or 2, wherein the formation of the permanent bond takes place at a temperature between room temperature and 200°C, during a maximum 12 days.

4. The method as claimed in claim 1 or 2, wherein the formation of the permanent bond takes place at a temperature between room temperature and 200°C, during a maximum 1 day.

5. The method as claimed in claim 1 or 2, wherein the formation of the permanent bond takes place at a temperature between room temperature and 200°C, during a maximum 1 hour.

6. The method as claimed in claim 1 or 2, wherein the formation of the permanent bond takes place at a temperature between room temperature and 200°C, during a maximum 15 minutes.

7. The method as claimed in one of the preceding claims, wherein the irreversible bond has a bond strength of greater than 1.5 J/m^2.

8. The method as claimed in one of claims 1 to 6, wherein the irreversible bond has a bond strength of greater than 2 J/m^2.

9. The method as claimed in one of claims 1 to 6, wherein the irreversible bond has a bond strength of greater than 2.5 J/m^2.

10. The method as claimed in one of the preceding claims, wherein during the reaction, a reaction product (10) with a greater molar volume than the molar volume of the second educt is formed in the reaction layer (7).

11. The method as claimed in one of the preceding claims, wherein the reservoir (5) is formed by plasma activation.

12. The method as claimed in one of the preceding claims, wherein the surface layer (6) consists essentially completely of an amorphous material, and the reaction layer (7) consists of an oxidizable material.

13. The method as claimed in claim 12, wherein the amorphous material comprises silicon oxide produced by thermal oxidation.

14. The method as claimed in claim 12 or 13, wherein the oxidizable material is predominantly of Si, Ge, InP, GaP or GaN.

15. The method as claimed in claim 12 or 13, wherein the oxidizable material is completely of Si, Ge, InP, GaP or GaN.

16. The method as claimed in one of the preceding claims, wherein between the second contact surface (4) and the reaction layer (7) there is a growth layer (8), consisting at least largely of a native oxide material.

17. The method as claimed in one of the claims 1 to 15, wherein between the second contact surface (4) and the reaction layer (7) there is a growth layer (8), consisting predominantly of native silicon dioxide.

18. The method as claimed in claim 16 or 17, wherein before the formation of a permanent bond the growth layer (8) and/or the surface layer (6) has an average thickness A between 1 angstrom and 10 nm.

19. The method as claimed in one of the preceding claims, wherein the reservoir is formed in a vacuum.

20. The method as claimed in one of the preceding claims, wherein the reservoir is filled by one or more of the steps cited below:

- exposing the first contact surface (3) to the atmosphere,
- exposing the first contact surface (3) to a fluid consisting predominantly of deionized H_2O and/or H_2O_2,
- exposing the first contact surface (3) to N_2 gas and/or O_2 gas and/or Ar gas and/or forming gas with an ion energy in the range from 0 to 200 eV.

21. The method as claimed in claim 20, wherein the atmosphere to which the first contact surface (3) is exposed comprises a high oxygen and/or water content.

22. The method as claimed in claim 20 or 21, wherein the fluid to which the first contact surface (3) is exposed consists completely of deionized H_2O and/or H_2O_2.

23. The method as claimed in claim one of the claims 20 to 22, wherein the gas to which the first contact surface (3) is exposed consists of 95% Ar and 5% H_2.

24. The method as claimed in one of the preceding claims, wherein the formation and the filling of the reservoir take place additionally on the second contact surface (4), and the formation of the permanent bond is additionally strengthened by reaction of the first educt with a second educt contained in a reaction layer (7') of the first substrate (1).

25. The method as claimed in one of the claims 1 to 23, wherein the formation and the filling of the reservoir take place additionally on the growth layer (8), and the formation of the permanent bond is additionally strengthened by reaction of the first educt with a second educt contained in a reaction layer (7') of the first substrate (1).

26. The method as claimed in one of the preceding claims, wherein the average distance (B) between the reservoir (5) and the reaction layer (7) immediately before formation of the permanent bond is between 0.1 nm and 15 nm.

27. The method as claimed in one of the claims 1 to 25, wherein the average distance (B) between the reservoir (5) and the reaction layer (7) immediately before formation of the permanent bond is between 0.5 nm and 5 nm.

28. The method as claimed in one of the claims 1 to 25, wherein the average distance (B) between the reservoir (5) and the reaction layer (7) immediately before formation of the permanent bond is between 0.5 nm and 3 nm.

29. The method as claimed in one of the preceding claims, wherein the irreversible bond has a bond strength which comprises twice the prebond strength.

30. The method as claimed in one of the claims 1 to 28, wherein the irreversible bond has a bond strength which comprises 4 times the prebond strength.

31. The method as claimed in one of the claims 1 to 28, wherein the irreversible bond has a bond strength which comprises 25 times the prebond strength.