The bonding process is carried out at a temperature that is elevated relative to room temperature. In this case, the bonding temperature is in particular greater than 25°C, preferably greater than 100°C, more preferably greater than 200°C, most preferably greater than 300°C, with utmost preference greater than 400°C, and even more preferably around 426°C. According to the phase diagram, aluminum has the greatest solubility for gallium of approximately 8 mol% between 77°C and 177°C

Preventing the forming of a liquid, eutectic phase in the boundary area is very difficult in the case of an Al-Ga diffusion pair. Since dissolving gallium in aluminum is preferred according to the invention and since diffusion is to take place as quickly as possible, a brief existence of a liquid phase according to the invention is acceptable. According to the invention, the bonding temperature during the bonding process is kept constant at this temperature up to the at least predominant, preferably complete, dissolution of gallium in aluminum.

The required time can be calculated by solving the one-dimensional diffusion equation knowing the diffusion constants of gallium in aluminum. Nevertheless, it may be necessary and useful to maintain the temperature for a shorter or longer time. The length of time for dissolving gallium in aluminum is in this case greater than 1 minute, preferably greater than 10 minutes, more preferably greater than 30 minutes, most preferably greater than 1 hour, with utmost preference greater than 2 hours, and even more preferably greater than 5 hours.

During the dissolution process, the pressure is preferably maintained or even increased on the substrates that are to be bonded with one another. The prevailing pressure is in particular greater than 1 Pa, preferably greater than 100 Pa, more preferably

Claims

1. Method for bonding a first substrate with a second substrate, wherein on the first substrate a bonding layer is applied that consists of a basic layer and a protective layer, with the following method steps:

- Application of an oxidizable basic material as a basic layer on a bonding side of the first substrate,
- At least partial covering of the basic layer with a protective material that is at least partially dissolvable in the basic material as a protective layer with a thickness of less than 100 nm,
- Bonding of the substrates wherein the protective material is dissolved completely in the basic material during the bonding.

2. Method according to Claim 1, characterized in that the basic material is oxygen-affine and in particular consists at least predominantly of aluminum and/or copper.

3. Method according to one of the preceding claims, wherein the application of the basic material and/or the covering of the basic material with the protective material is/are carried out by deposition.

4. Method according to one of the preceding claims, wherein the protective layer is applied in such a way that the basic layer is sealed at least predominantly, preferably completely, relative to the atmosphere.

5. Method according to one of the preceding claims, wherein the protective layer is treated before the bonding step with one or more of the following processes:

- Chemical oxide removal, in particular by a
    - Gaseous reducing agent and/or
    - Liquid reducing agent

- Physical oxide removal, in particular with plasma
- Ion-Assisted Chemical Etching, in particular
    - Fast Ion Bombardment (FAB, sputtering)
    - Grinding, and/or
    - Polishing.

6. Method according to one of the preceding claims, wherein one or more of the following materials are selected as basic material and/or protective material:

- Metals, in particular Cu, Ag, Au, Al, Fe, Ni, Co, Pt, W, Cr, Pb, Ti, Te, Sn, Zn, Ga,
- Alkali metals, in particular Li, Na, K, Rb, Cs,
- Alkaline-earth metals, in particular Mg, Ca, Sr, Ba,
- Alloys,
- Semiconductors, provided in particular with corresponding doping,
    - Element semiconductors, in particular Si, Ge, Se, Te, B, Sn,
    - Compound semiconductors, in particular GaAs, GaN, InP, InxGa1-xN, InSb, InAs, GaSb, AlN, InN, GaP, BeTe, ZnO, $CuInGaSe_2$, ZnS, ZnSe, ZnTe, CdS, CdSe, CdTe, Hg(1-x)Cd(x)Te, BeSe, HgS, AlxGa1-xAs, GaS, GaSe, GaTe, InS, InSe, InTe, $CuInSe_2$, CuInS2, $CuInGaS_2$, SiC, SiGe.

7. Substrates bonded using a method according to one of the preceding claims.