widely varied manifestations of eutectic connections and so-called intermetallic compound connection applications are used. As examples, solder joints based on lead/tin solder, copper-silver-tin solder, indium-based solders or else gold-tin or gold-silicon or aluminum-germanium, as well as copper-tin (intermetallic compound Cu3Sn) can be cited here. The disadvantage of these methods lies in problems of both manufacturing logistics and technology. In many cases, these bond connections are to be produced in an area of manufacturing where only a certain metallization (e.g., Cu) is established and qualified. In this case, it would be an immense additional expense, m addition to this metallization, to build and also to qualify' the infrastructure for another metallization. From the technological aspect, eutectic connections are to be considered critical with respect to the long-term stability. Certain connections are extremely brittle, and mechanical fatigue phenomena, i.a., can result. In addition, for certain metallizations, very narrow tolerances with respect to the mixing ratio are observed to guarantee the desired properties (e.g., melt temperature, mechanical and electrical properties) of the eutectic connection. In addition, diffusion effects in connection with eutectic connections can cause problems. Thus, for example, it would be a serious problem if tin were to diffuse from one interface between two copper contact surfaces through the entire copper contact and were to reach the underlying barrier layer between the copper contact and the underlying layer. Because of the altered metal composition, this would lead to the mechanical delamination of the copper in this interface and thus result in a mechanical defect of the component, which could occur only after several years in the field. These are effects that can occur in this form only with microstructures, since here, very thin layers are used in which such effects can only play a role.

Embodiments of this invention disclose a method with which a reduced process temperature and/or a reduced process time can be achieved in metallic bond connections.

According to an aspect of the present invention, there is provided a method for production of a permanent, electrically conductive connection between a first surface comprising metallic and non-metallic regions of a first substrate and a second surface comprising metallic and non-metallic regions of a second substrate, the method including: conditioning the metallic regions and the non-metallic regions of the first and second surfaces by producing surface defects such that when connecting the first and second surfaces a permanent, electrically conductive bond is produced at least primarily by substitution diffusion between metallic ions and/or metal atoms of the metallic regions of the two surfaces, aligning and bonding the first and second surfaces, whereby a temperature treatment is applied such that a reorganization of structure of a near-surface layer of the metallic regions of the first and second surfaces takes place to eliminate surface defects.

Claims:

1. A method for production of a permanent, electrically conductive connection between a first surface comprising metallic and non-metallic regions of a first substrate and a second surface comprising metallic and non-metallic regions of a second substrate, the method comprising:

conditioning the metallic regions and the non-metallic regions of the first and second surfaces by producing surface defects such that when connecting the first and second surfaces a permanent, electrically conductive bond is produced at least primarily by substitution diffusion between metallic ions and/or metal atoms of the metallic regions of the two surfaces,

aligning and bonding the first and second surfaces, whereby a temperature treatment is applied such that a reorganization of structure of a near-surface layer of the metallic regions of the first and second surfaces takes place to eliminate surface defects.

2. The method according to claim 1, wherein the temperature treatment is applied such that when the first and second surfaces are in close contact, the latter are plastically deformed resulting in closure of empty spaces in the interface between the metallic regions and the non-metallic regions of the first and second surfaces.

3. The method according to one of the preceding claims, wherein the conditioning of the metallic regions and the non-metallic regions of the first and second surfaces is effected by producing near-surface layers with surface defects by implanting gas ions and/or application of metallic nano particles.

4. The method according to one of the preceding claims, wherein hydrogen is additionally implanted during the conditioning of the metallic regions and the non-metallic regions of the first and second surfaces.

5. The method according to one of the preceding claims, wherein the conditioning comprises optimization of the surface roughness of the metallic regions and the non-metallic regions of at least one of the surfaces.

6. The method according to one of the preceding claims, wherein the surface defects are eliminated by reorganization of the structure of the metallic regions.