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 process for the production of a permanent, electrically conductive connection between a first metal surface of a first substrate and a second metal surface of a second substrate, the process including the steps of: conditioning of the first and second metal surfaces by implanting gas ions or by application of metallic nanoparticles in such a way that in a connection of the metal surfaces a permanent, electrically conductive connection - produced at least by surface diffusion of metal ions and/or metal atoms of the two metal surfaces and/or grain boundaries diffusion - is produced, orientation and connection of the first and second metal surfaces, whereby during the conditioning, orientation and connection, a process temperature of at most 300°C is not exceeded.

Also, all combinations that consist of at least two of the features that are indicated in the description, the claims and/or the figures fall within the scope of the invention. In the indicated ranges of values, values that lie within the above-mentioned limits are also disclosed as boundary values and can be claimed in any combination.

Embodiments of this invention disclose methods and processes by means of which the bond temperature for authentic bond connections can be reduced dramatically, and this thus makes possible the use of connections, which do not require foreign metal, for a broad area of use. An additional use as per embodiments of this invention is also the acceleration of the process, which can be achieved in the case of ideal, selected process parameters and which increases the economic efficiency of the process.

Diffusion can be divided in general into substitutional and interstitial diffusion.

In the substitution diffusion, the diffusion jumps of the individual atom take place along each point in the grid, on which other atoms could be located. As a result, such a diffusion jump can actually take place, if necessary, at the position to which an atom would jump but no other atom can be located (exceptions exist: direct atom exchange mechanisms, which are discussed scientifically but are not yet detected; if they exist, they occur so rarely in comparison to the other atom exchange mechanisms that they can be

CLAIMS:

1. Process for the production of a permanent, electrically conductive connection between a first metal surface of a first substrate and a second metal surface of a second substrate with the following method steps:

- Conditioning of the first and second metal surfaces by implanting gas ions or by application of metallic nanoparticles in such a way that in a connection of the metal surfaces a permanent, electrically conductive connection - produced at least by surface diffusion of metal ions and/or metal atoms of the two metal surfaces and/or grain boundaries diffusion - is produced,
- Orientation and connection of the first and second metal surfaces, whereby during the conditioning, orientation and connection, a process temperature of at most 300°C is not exceeded.

2. Method according to Claim 1, wherein the first and/or second metal surface(s) has (have) a layer thickness $S < 5$ nm.

3. Method according to one of the preceding claims, wherein hydrogen is implanted to avoid oxidation in the conditioning of the first and second metal surfaces.

4. Method according to one of the preceding claims, wherein the conditioning includes that the surface roughness of at least one of the metal surfaces is < 20 nm.

5. Method according to one of the preceding claims, wherein the first substrate comprises a non-metallic region surrounding the metal surface and/or the second substrate comprises a non-metallic region surrounding the metal surface.