

## ARRANGEMENT AND METHOD FOR JOINING AT LEAST TWO JOINING PARTNERS

### TECHNICAL FIELD

[0001] The instant disclosure relates to an arrangement and method for joining at least two joining partners, in particular for sintering semiconductor components to a semiconductor substrate.

### BACKGROUND

[0002] Power semiconductor module arrangements often include at least one semiconductor substrate arranged in a housing. A semiconductor arrangement including a plurality of controllable semiconductor components (e.g., two or more IGBTs in a half-bridge configuration) is usually arranged on at least one of the at least one substrate. Each substrate usually comprises a substrate layer (e.g., a ceramic layer), a first metallization layer deposited on a first side of the substrate layer and a second metallization layer deposited on a second side of the substrate layer. The controllable semiconductor components are mounted, for example, on the first metallization layer. Usually, the semiconductor components are sintered to the semiconductor substrate. A sinter layer is arranged between each of the semiconductor components and the semiconductor substrate and the semiconductor components are then pressed onto the sinter layer by exerting a defined pressure. Often, hard punches are used to exert the pressure. In order to evenly distribute the pressure and to protect the semiconductor components from damage and contamination by potentially harmful substances, one or more foils are usually arranged between the punches and the semiconductor components.

[0003] There is a need for an improved arrangement and method that allow for an easy, quick, defined and precise positioning of the joining partners, foils and punches.

### SUMMARY

[0004] An arrangement for joining two joining members includes a first part comprising a support surface, a first carrier element configured to carry at least one foil, a transportation unit configured to arrange the first carrier element with at least one foil arranged thereon in such a way that the at least one foil is arranged above the support surface of the first part in a vertical direction, and a second part configured to exert pressure to a joining stack, when the joining stack is arranged on the support surface. The joining stack comprises a first joining member arranged on the support surface, a second joining member arranged on the first joining member, and an electrically conductive connection layer arranged between the first joining member and the second joining member. When pressure is exerted to the joining stack by the second part, the at least one foil is arranged between the second part and the joining stack and is pressed onto the joining stack, and the joining stack is pressed onto the first part, thereby compressing the connection layer and forming a substance-to-substance bond between the first and the second joining member.

[0005] A method includes arranging a first joining member, an electrically conductive connection layer, and a second joining member on a support surface of a first part, wherein the electrically conductive connection layer is arranged between the first joining member and the second

joining member. The method further includes arranging at least one foil on a first carrier element, using a transportation unit to arrange the first carrier element in such a way that the at least one foil is arranged above the support surface of the first part in a vertical direction, and exerting pressure to the joining stack by means of a second part, wherein, when the at least one foil is arranged above the support surface and pressure is exerted to the joining stack by the second part, the at least one foil (is arranged between the second part and the joining stack and is pressed onto the joining stack, and the joining stack is pressed onto the first part, thereby compressing the connection layer and forming a substance-to-substance bond between the first and the second joining member.

[0006] The invention may be better understood with reference to the following drawings and the description. The components in the figures are not necessarily to scale, emphasis is instead being placed upon illustrating the principles of the invention. Moreover, in the figures, like reference numerals designate corresponding parts throughout the different views.

### BRIEF DESCRIPTION OF THE DRAWINGS

[0007] FIG. 1 illustrates a cross-sectional view of an arrangement for joining two joining members.

[0008] FIG. 2 schematically illustrates a cross-sectional view of another arrangement for joining two joining members before performing the step of joining the joining members.

[0009] FIG. 3 schematically illustrates a cross-sectional view of the arrangement of FIG. 2 before performing the step of joining the joining members.

[0010] FIG. 4 schematically illustrates a cross-sectional view of the arrangement of FIG. 2 while joining the joining members.

[0011] FIG. 5 schematically illustrates a cross-sectional view of another arrangement for joining two joining members.

[0012] FIG. 6 schematically illustrates a cross-sectional view of another arrangement for joining two joining members.

[0013] FIG. 7 schematically illustrates a cross-sectional view of another arrangement for joining two joining members before joining the joining members.

[0014] FIG. 8 schematically illustrates a cross-sectional view of the arrangement of FIG. 7 before joining the joining members.

[0015] FIG. 9 schematically illustrates a cross-sectional view of the arrangement of FIG. 7 while joining the joining members.

[0016] FIG. 10 schematically illustrates a cross-sectional view of another arrangement for joining two joining members.

[0017] FIG. 11 schematically illustrates an exemplary flow of different components in an arrangement comprising several process chambers.

[0018] FIG. 12 schematically illustrates another exemplary flow of different components in an arrangement comprising several process chambers.

[0019] FIG. 13 schematically illustrates another exemplary flow of different components in an arrangement comprising several process chambers.