Device and Method for Bonding

Specification

The invention relates to a device for bonding as claimed and a corresponding method.

In the semiconductor industry product wafers are more and more often temporarily cemented to carrier wafers. The cement, the so-called bonding adhesive, is applied to the product wafer and/or the carrier wafer in the form of a layer with a thickness which is as uniform as possible. After the coating process the two wafers must however be pressed onto one another with high forces. This process is known under the term bonding. The pressure discs used which apply pressure to the two wafers should be flat according to the prior art, in order to apply a bond force which is as uniform as possible overall. Accordingly the pressure discs are also exactly produced. The lower disc is produced as a resting part of a bond chuck, therefore a sample carrier. The upper disc is called the pressure disc and is accordingly mounted on the top of the bond chamber.

After a product and/or a carrier wafer has been lacquered with a spin lacquering method, generally a so-called "edge bead" is established on the layer edge based on rheological and fluid-dynamic properties. This "edge bead" is an accumulation of material which can be found on a round substrate, a wafer, along the entire edge. The difference between the material thickness in the center and the material thickness on the edge is only a few microns, often even only a few nanometers. In bonding, therefore in the application of the bond force, very often the problem of a nonuniform bond force and/or of the forcing-out of the protruding or excess cement arises therefrom.

In the ideal case one layer has a homogeneous thickness for the bonding process as claimed in the invention. In this connection homogenous thickness means that the thickness of the bonding layer is the same at any position or is within an acceptable tolerance. But experience shows that even under ideal bonding conditions, therefore in the case of a homogeneous layer thickness, a perfectly evenly machined pressure disc, a perfectly evenly machined bond chuck, and uniform, homogenous pressure application, after the bonding process there can be a layer with an inhomogeneous thickness. The reason for this is the rheological and fluid-dynamic properties of the layer and the prevailing initial and boundary conditions of the physical problem. Since the material cannot spread equally quickly in the plane in the center, like the material on the edge of the substrate, an increased flow velocity occurs in the vicinity of the edge. It could be said that the material in the center itself is obstructed, conversely the edge material can drain freely to the outside. For a layer with a corresponding "edge bead" the situation would deteriorate accordingly, since in this case even more material is present on the edge than in the center per unit of area.

Embodiments of this invention disclose generic devices and methods for bonding such that the indicated problems of the inhomogeneous layer thickness can be prevented or at least reduced.

According to a first aspect of the present invention, there is provided a device for bonding of a second substrate onto a first substrate with the following features: a receiving apparatus for receiving the first substrate which has been coated with a bond layer and the second substrate which is held on the bond layer, an action apparatus for applying a bond force to the second substrate on one action side of the second substrate, which side faces away from the bond layer

proceeding from an initial zone A which lies within an edge zone R of the action side as far as action on the entire action side, wherein the second substrate, which is deposited on the bond layer, can be bent by the action apparatus towards the center of the bond layer and the action apparatus comprises a pressure transfer disc with a convexly curved pressure transfer side, wherein the pressure transfer disc stays convexly curved during the bonding of the second substrate onto the first substrate, and wherein the pressure transfer disc is formed from a lower disk which encompasses the pressure transfer side and of a retaining disc which fixes the pressure transfer disc.

According to a second aspect of the present invention, there is provided a method for bonding of a second substrate onto a first substrate with the following steps, especially the following sequence: receiving the first substrate which has been coated with a bond layer and the second substrate which is held on the bond layer, applying a bond force to the second substrate on one action side of the second substrate, which side faces away from the bond layer proceeding from an initial zone A which lies within an edge zone R of the action side as far as action on the entire action side, wherein the second substrate, which is deposited on the bond layer, is bent by the action apparatus towards the center of the bond layer and the action apparatus comprises a pressure transfer disc with a convexly curved pressure transfer side, wherein the pressure transfer disc stays convexly curved during the bonding of the second substrate onto the first substrate.

All combinations of at least two of the features given in the specification, the claims and/or the drawings also fall within the scope of the invention. For value ranges, values within the indicated limits will also be considered to be disclosed as boundary values and will be claimed in any combination.

Hereinafter it is distinguished between a product substrate and a substrate to illustrate the