Mounting Apparatus for Handling of Structured Substrates

Specification

This invention relates to a mounting apparatus for handling of structured substrates, a method for handling of structured substrates and a use.

Mounting apparatus, also sample holders, are used in the semiconductor industry among others for fixing of substrates which are thinned or processed in some other way on the mounting apparatus. The thinning is called back-grinding and the target thickness of the substrates after back-grinding is in part less than 100 μm, especially less than 50 μm, preferably less than 20 μm. Ever-continuing miniaturization constitutes a major technical problem for handling of substrates, especially since the sample holders which are used for this purpose have extremely flat surfaces so that the fixing of structured substrates on these surfaces is impossible or is only very poorly possible. Furthermore, the back of a substrate which is opposite the front with the structures must generally remain flat and should not be made undulated and/or arched by the structuring on the front. Mainly in the back-thinning of the back of the substrate must the back remain very flat. Otherwise, fracture, nonuniform back-thinning, or other damage to the substrates occurs.

Embodiments of this invention disclose a mounting apparatus and a corresponding method with which the handling of the aforementioned structured substrates is enabled in back-grinding or other processes and especially in the detachment of the substrates without damaging them,

According to a first aspect of the present invention, there is provided a mounting apparatus for handling of a structured substrate which has structures, the mounting apparatus having a soft material layer compliant for accommodating the structured substrate on a receiving surface by an elastic deformation of the soft material layer around the structures, wherein the soft material layer is adapted to be pressurized with negative pressure and/or overpressure, wherein there are fixing means for fixing of the structured substrate on the receiving surface, wherein the modulus of elasticity of the material layer is less than 100 GPa, and wherein the material layer consists of a polymer, wherein the elasticity of the soft material layer allows deformation of the soft material layer under negative pressure to enclose the structures and under overpressure to press the structures out of the soft material layer, and wherein a deactivation state for the fixing means includes pressurizing the soft material layer with overpressure to press the structures at least partially out of the soft material layer.

According to a second aspect of the present invention, there is provided a method for handling of a structured substrate which has structures with the following steps, especially the following sequence: accommodation of the structured substrate on a receiving surface of a soft material layer, the soft material layer compliant for accommodating the structured substrate on a receiving surface by an elastic deformation of the soft material layer around the structures into the soft material layer, wherein the soft material layer is adapted to be pressurized with negative pressure and/or overpressure, wherein the modulus of elasticity of the soft material layer is less than 100 GPa, and wherein the soft material layer consists of a polymer, and wherein the elasticity of the soft material allows deformation of the soft material layer under negative pressure to enclose the structures and under overpressure to press the structures out of the soft material layer; and fixing of the structured substrate on the soft material layer, especially intensified by additional, preferably controllable fixing means.

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

Embodiments of the invention are based on the idea, especially in handling of structured substrates whose structures are especially predominantly with a height of greater than 1 μm, preferably predominantly greater than 10 μm, still more preferably predominantly greater than 50 μm, most preferably predominantly greater than 100 μm, of holding them such that the structures of the front of the substrate dip completely into a soft material layer with preferably low adhesion so that the back of the substrate remains flat and the substrate can be easily and simply detached again after processing.

As per embodiments of the invention a soft material layer is defined as a compliant material layer which in particular is able to accommodate structures. The definition of "soft" does not necessarily relate to the physical parameters of the modulus of elasticity which describes a compliance of the material in the sense of Hooke's Law, but rather to the capacity to accommodate structures. In one preferred embodiment the structures sink in the porous and/or fibrous material layer. In all those embodiments in which the definition of "soft" is intended to mean a compliant material in the sense of Hooke's Law, the modulus of elasticity is less than 100 GPa, preferably less than 1 GPa, more preferably less than 100 MPa, most preferably less than 1 MPa, most preferably of all less than 1 kPa.

As per embodiments of the invention a low-adhesive material layer is defined as a material layer

Claims

1. A mounting apparatus for handling of a structured substrate (1) which has structures (3), the mounting apparatus having a soft material layer (5) compliant for accommodating the structured substrate (1) on a receiving surface (5o) by an elastic deformation of the soft material layer (5) around the structures (3), wherein the soft material layer (5) is adapted to be pressurized with negative pressure and/or overpressure, wherein there are fixing means for fixing of the structured substrate (1) on the receiving surface, wherein the modulus of elasticity of the material layer (5) is less than 100 GPa, wherein the material layer (5) consists of a polymer, wherein the elasticity of the soft material layer (5) allows deformation of the soft material layer (5) under negative pressure to enclose the structures (3) and under overpressure to press the structures (3)out of the soft material layer (5), and wherein a deactivation state for the fixing means includes pressurizing the soft material layer (5) with overpressure to press the structures (3) at least partially out of the soft material layer (5).

2. The mounting apparatus as claimed in Claim 1, wherein the material layer (5) on the receiving surface (5o) has a surface energy of less than 0.1 J/m^2, especially less than 0.01 J/m^2, preferably less than 0.001 J/m^2, even more preferably less than 0.0001 J/m^2, ideally less than 0.00001 J/m^2.

3. The mounting apparatus as claimed in one of the preceding claims, wherein the receiving surface (5o) can be exposed to a volumetric flow passing through the material layer (5) at least on one effective contact surface with the structured substrate (3).

4. The mounting apparatus as claimed in one of the preceding claims, which the fixing means has a pressurization apparatus which can be controlled especially with a software-supported control apparatus for the pressurization of the soft material layer (5) with the negative pressure and/or the overpressure.

5. A method for handling of a structured substrate (1) which has structures (3) with the following steps, especially the following sequence:

- accommodation of the structured substrate (1) on a receiving surface (5o) of a soft material layer (5), the soft material layer (5) compliant for accommodating the structured substrate (1) on a receiving surface (5o) by an elastic deformation of the soft material layer (5) around the structures (3) into the soft material layer (5), wherein the soft material layer (5) is adapted to be pressurized with negative pressure and/or overpressure, wherein the modulus of elasticity of the soft material layer (5) is less than 100 GPa, wherein the soft material layer (5) consists of a polymer, and wherein the elasticity of the soft material (5) allows deformation of the soft material layer (5) under negative pressure to enclose the structures (3) and under overpressure to press the structures (3) out of the soft material layer (5); and
- fixing of the structured substrate (1) on the soft material layer (5), especially intensified by additional, preferably controllable fixing means.

6. The method as claimed in Claim 5, wherein after the processing step, detachment takes place, especially predominantly, preferably exclusively, by deactivation of the fixing, especially pressure equalization or pressurization on the receiving surface to overpressure the soft material layer (5) to press the structures at least partially out of the soft material layer (5).

7. A use of a mounting apparatus as claimed in one of Claims 1 to 4 for handling of structured substrates (1), especially semiconductor substrates, with a thickness d less than 100 μm, preferably less than 50 μm, even more preferably less than 20 μm.

8. The use of a mounting apparatus as claimed in Claim 7, wherein the device is used in a debonder.