Device and Method for Coating of a Carrier Wafer

Specification

This invention relates to a device and a method for coating of an inner circular surface of a coating surface of a carrier wafer with a coating material ~~as claimed in Claim 1 and 9~~.

In semiconductor technology, methods for temporary bonding are playing a more and more important part to be able to optimally handle structure wafers which are becoming thinner and larger in area. The handling of structure wafers in the prior art has been especially improved by only one part of the structure wafer being temporarily bonded to the carrier wafer, preferably a peripheral edge. In this way contact of adhesive with the structured side of the structure wafer is avoided as much as possible. This is achieved in the prior art by only one edge zone of the coating surface of the carrier wafer being made adhesive, in particular by an inner circular surface of the wafer being coated with a coating material which reduces the adhesive force. A nonadhesive coating material is preferably, but not restrictively, an Anti Sticking Layer Material (ASL) such as for example EasyClean Coat 1000 from 3M.

The prior art has instantaneously following steps for production. First the edge zone B of a carrier wafer is coated with a resist, for example a photoresist. The photoresist is cured in a furnace or on a heating plate. Afterwards an ASL is applied over the entire surface. The ASL material cannot reach the surface of the carrier wafer which has been covered by the photoresist. After a certain action time in which a molecular layer has formed on the central region of the carrier wafer which is not covered with the photoresist, the remaining ASL material is spun off. Afterwards the

photoresist is removed, for example with acetone. At this time the carrier wafer consists of two zones, one edge zone without ASL coating and a core zone with ASL coating. Afterwards an adhesive is applied on the entire carrier wafer. The adhesive adheres very well to the edge zone which has not been covered with ASL material. The adhesive strength of the adhesive in the core zone which has been coated with ASL material is very low. The cement is used in this core zone mainly to support structures of the structure wafer which is to be bonded later to the carrier wafer. It is clearly apparent from the prior art that several steps are required for producing the two zones. First, the application of the photoresist, second the curing of the photoresist, third the application of the ASL material, fourth the removal of the photoresist, and fifth the application of the adhesive.

The application of the coating and of the adhesive to the carrier wafer will take place as economically and quickly as possible, but at the same time in high quality, therefore especially a layer thickness as uniform as possible.

~~The object~~Embodiments of this invention ~~is therefore to optimize~~disclosure a device and a method for coating of a carrier wafer such that application can take place quickly and economically, but at the same time with high quality.

~~This object is achieved with the features of Claims 1 and 9. Advantageous developments of the invention are given in the dependent claims.~~According to an aspect of the present invention, there is provided a method for coating of an inner circular surface of a coating surface of a carrier wafer with a coating material, the method comprising the steps of : application of the coating material to the inner circular surface by a first application means and distribution of the coating material by rotating the carrier wafer around an axis of rotation by rotating means, wherein during the distribution of the coating material by a second application means an outer circular ring surface which surrounds the inner circular surface is applied with a coating inhibitor which at least inhibits the coating of the outer circular ring surface, wherein the coating materials is an antiadhesion material, and wherein the coating inhibitor is applied to the outer circular ring surface prior to the coating material, such that the coating material moves away over the coating inhibitor and the outer circular ring surface is not coated by the coating material.

All combinations of at least two of the features given in the specification, the claims and/or the figure also

fall within the framework 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.

The basic idea of embodiments of this invention is to provide the coating of the carrier wafer with a coating material in different zones of the coating surface of the carrier wafer at least largely at the same

is a carrier wafer with an only partially coated coating surface which can be produced in a continuous and single-stage process as ~~claimed in~~per embodiments of the invention. In the uncoated region subsequently, especially by means of the second application means for applying the solvent, adhesive can be applied in the uncoated region of the coating surface and distributed. The adhesive can, as already known in the prior art, also be applied in a blanket manner, over the entire substrate, its covering the regions with low adhesive strength and high adhesive strength equally. Thus as ~~claimed in~~per embodiments of the invention a carrier wafer can be produced with a coating surface which has several zones for accommodating a structure wafer in a two-stage production method as ~~claimed in~~per embodiments of the invention. Coating inhibitors and coating material are preferably applied at the same time. The activation sequence calls for the solvent to be applied preferably at latest until the coating material is reached, more preferably at the same time with the coating material, most preferably prior to the coating material. The deactivation sequence calls for the coating with the coating material to end before coating with the solvent.

Preferably no significant intermixing of the solvent with the coating material takes place. In the boundary layer the coating material is evaporated at most more rapidly by the solvent. The intermixing of the coating material with the coating inhibitor, especially solvent, is to be so small as ~~claimed in~~per embodiments of the invention that the zone which is not to be coated is not coated with the coating material. After a successful coating of the central region (especially inner circular ring surface) the condition can be tested afterwards by a measurement method, preferably by a contact angle measurement device. Advantageously the contact angle in the area not to be coated according to the process as ~~claimed in~~ per embodiments of the invention has been changed at most by 15°, more preferably at most by

10°, still more preferably at most by 5°, most preferably by 0°.

The separate process step of removal of the material, which step was used in the past, on the wafer edge as ~~claimed in~~per embodiments of the invention is converted into a process of flushing of the edge which proceeds especially at the same time with the coating in order to inhibit the coating by a coating material or preferably to completely prevent it. The especially blanket application of the adhesive is not a critical component of the method or device as ~~claimed in~~per embodiments of the invention, but can be implemented in them.

According to one advantageous embodiment it is provided that the first application means is arranged or can be arranged such that the application of the coating material takes place in the region of the rotation axis R of rotation, especially concentrically to the carrier wafer. In this way a homogenous distribution of the coating material on the entire coating surface is enabled since the distribution of the coating material takes place extremely uniformly especially at a constant rotational speed along the coating surface. The carrier wafer is rotated by accommodating and fixing of the carrier wafer on a rotatable receiver, especially a chuck, the accommodating and fixing of the carrier wafer taking place in an alignment as exactly concentric as possible to the axis of rotation of the receiving apparatus.

Because the second application means is arranged or can be arranged such that the application of the coating inhibitor takes place especially on one peripheral section of the outer circular ring surface 1a in the region of a radially inner edge of the outer circular ring surface, the principle of distribution of the coating inhibitor by rotation of the carrier wafer can also be used here so that an at least largely simultaneous application of the coating inhibitor with the coating material is conceivable as ~~claimed in~~per embodiments of the invention. Only the application site on the

coating surface

differs, the application of the solvent to the carrier wafer taking place farther away from the axis R of rotation than the application of the coating material.

Here it is advantageous if there are control means as ~~claimed in~~as per embodiments of the invention for controlling an application amount and/or an application pressure and/or an application instant and/or an application speed and/or an application angle and/or an application point and/or an application position of the first and/or second application means. If these parameters are made to be adjustable, the device as ~~claimed in~~per embodiements of the invention and the method as ~~claimed in~~per embodiments of the invention can be set to different combinations of coating materials and corresponding coating inhibitors. With greater application of the amount of coating inhibitors on the one hand the coating material is more effectively detached or dissolved, or that the coating material is more strongly hindered by the coating inhibitor from coating or covering the outer edge zone, on the other hand more coating inhibitor is consumed. By increasing the application pressure or the application speed or by choosing a skillful application angle the discharge of the coating inhibitor and coating agent can be optimized especially without increasing the application amount.

To the extent there are curing agents for curing of the coating material, the single-stage or two-stage process as ~~claimed in~~per embodiments of the invention is further optimized since the curing of the coating material can take place especially at the same time with the distribution of the coating material on the coating surface. In conjunction with the ASL materials the monomolecular or multimolecular layer is understood during curing. In one embodiment as ~~claimed in~~per embodiements of the invention these layers are formed by segregation effects on the surface. "Curing" below means the formation of a nonadhesive layer.

According to another advantageous embodiment of the invention, it is provided that the

second application means have at least one line which can be arranged pointing with one outlet end toward the outer circular ring surface. Thus a directed jet and controlled application of the coating inhibitor in regions of the coating surface are possible, where the coating material in the distribution of the coating material is to be specially dissolved, or in general is to be kept away so that it does not cure there ("Curing" - see above).

Here it is especially advantageous if the second application means, especially on each outlet end, have an especially controllable nozzle. The inner nozzle typically has an opening diameter of 0.125 inch, the outer nozzle typically an opening diameter of 0.25 inch. Nozzles with smaller or larger opening diameters are also conceivable. The opening diameters are greater than 0.001 inch, preferably greater than 0.01 inch, more preferably greater than 0.1 inch, especially smaller than 1 inch. By this measure the device as ~~claimed in~~per embodiments of the invention can be set not only to different coating material and solvent combinations, but also can be set to different sizes of the carrier wafer or the desired ratio of the size of the adhesion zone to the antiadhesion zone.

To the extent features which are disclosed according to the device also imply method features, they should also be considered as disclosed according to the method and vice versa.

Other advantages, features and embodiments of the invention are disclosed below.

Figure 1 shows a perspective view of one embodiment of the device as claimed in the invention before application of the coating material and

Figure 2 shows one embodiment according to Figure 1 after implementing the two-step process as claimed in the invention.

The same or equivalent components in the figures are labeled with the same reference numbers.