Device and Method for Stripping a Product Substrate from a Carrier Substrate

Specification

The invention relates to a device ~~according to Claim 1~~ and a method ~~according to Claim 14~~ for stripping a product substrate from a carrier substrate.

The back-thinning of product substrates is often necessary in the semiconductor industry and can take place mechanically and/or chemically. For purposes of back-thinning, in general the product substrates are temporarily fixed on a carrier, there being various methods for the fixing. The carrier material can be, for example, films, glass substrates or silicon wafers.

Depending on the carrier materials used and the interconnect layer used between the carrier and the product substrate, different methods for dissolving or destroying the interconnect layer are known, such as, for example, the use of UV light, laser beams, the action of temperature, or solvents.

Stripping increasingly constitutes one of the most critical process steps since thin substrates with substrate thicknesses of a few microns easily break during stripping/peeling or are damaged by the forces that are necessary for the stripping process.

Moreover, thin substrates have hardly any stability of shape or none at all and typically curl without support material. During handling of back-thinned wafers, therefore, fixing and support of the wafers are essentially indispensable.

Embodiments~~Therefore, the object~~ of this invention ~~is to~~ devise a device and a method to detach such a product substrate from a carrier in as nondestructive a manner as possible.

In one aspect, there is provided a device for stripping a product substrate from a carrier substrate connected to the product substrate by an interconnect layer by means of a flexible film that is mounted on a film frame and that comprises an adhesive layer for holding the product substrate in a bonding surface section of the film,

– the film being mounted on the film frame in an attachment section of the film that surrounds the bonding surface section, and

– the film comprising a stripping section that is located between the bonding surface section and the attachment section,

– wherein a holding means for holding the carrier substrate and for applying a force Fs acting on the carrier substrate is provided,

– wherein connection release means comprising fluid means for at least partial detachment of the interconnect layer are made to act exclusively in the region of a periphery of the product substrate in a position of the carrier substrate applied with the force Fs, and

– wherein the device has stripping means with a film frame holder holding and applying a force to the film frame for effecting a stripping of the product substrate from the carrier substrate from the periphery, wherein the stripping means is made to strip the product substrate by deforming the flexible film by the force Fs and a force Ff that is directed against the force Fs and acts on the film frame.

In another aspect, there is provided a method for stripping a product substrate from a carrier substrate connected to the product substrate by an interconnect layer by means of a flexible film that is mounted on a film frame and that comprises an adhesive layer for holding the product substrate in a bonding surface section of the film,

– the film being mounted on the film frame in an attachment section of the film that surrounds the bonding surface section, and

– the film comprising a stripping section that is located between the bonding surface section and the attachment section, wherein the carrier substrate is held by a holding means,

– wherein connection release means comprising fluid means for at least partial detachment of the interconnect layer exclusively act in the region of a periphery of the product substrate in a position of the carrier substrate applied with force Fs by the holding means, and

– wherein stripping means effect a stripping of the product substrate from the carrier substrate from the periphery, wherein the product substrate is stripped by deforming the flexible film by a force Ff that is directed against the force Fs and acts on the film frame.

~~This object is achieved with the features of Claims 1 and 14. Advantageous further developments of the invention are given in the dependent claims.~~ The framework as per embodiments of the invention also encompasses all combinations of at least two of the features given in the specification, the claims, and/or the figures. In the specified value ranges, values that lie within the indicated limits will also be disclosed as boundary values, and they are to be claimed in any combination.

Embodiments of t~~T~~he invention are~~is~~ based on the idea of further developing a generic device and a generic method by the elasticity or flexibility of a film mounted on a film frame being used to carefully strip the product substrate starting from the edge of the product substrate namely by deforming the film, especially in a stripping section of the film. In this way, the product substrate is immediately available for other process steps directly after separation and is protected by the film and the film frame. Many process steps can be carried out directly on the product substrate mounted on the film frame.

In other words: the flexible film by means of a force bordering the film frame and the adhesive layer that bonds the product substrate in the bonding surface section of the film delivers a tensile force to the product substrate, by which the product substrate is stripped, especially peeled, from the carrier substrate.

A product substrate is defined as a product substrate, for example a semiconductor wafer, which is conventionally thinned to a thickness of between 0.5 µm and 250 µm, the trend being toward thinner and thinner product substrates. Embodiments of the~~This~~ invention works especially effectively with product substrates that themselves have flexibility similar to the film mounted on the film frame. In the device according to embodiments of the invention and the method according to embodiments of the invention, the product substrate is peeled from the carrier substrate, especially proceeding concentrically from the