MARK FIELD, METHOD AND DEVICE FOR DETERMINING POSITIONS

The present invention relates to a mark field, a device for determining X-Y positions of structural features of structures arranged on a substrate and a corresponding method.

In industry, it is of decisive importance to obtain a statement about the position of structures on a substrate. The difference between the real actual position and the ideal desired position of a structure is of particular interest. In order to determine the actual positions of structures, one can introduce a coordinate system and specify the position of the structures in relation to this coordinate system. For the most part, this is a body-fixed coordinate system, i.e. a coordinate system assigned to the substrate. The coordinate system is termed a substrate coordinate system in the remainder of the document.

However, in order to be able to measure all structures, a relative movement must take place between the substrate and the measurement system, particularly an optical system with a camera. That is necessary, as not all structures are located in the viewing area of the measurement system. Were all of the structures to be measured located in the viewing area of the measurement system, a relative movement between the measurement system and the substrate would of course not be necessary.

The relative movement takes place for the most part by means of an active movement of the substrate holder, on which the substrate is fixed, so that the filigrane optical system does not have to be moved. In this case, the position of the substrate holder must be determined very accurately, in order to be able to determine the distances which the substrate holder has covered. The position of the substrate holder must therefore be specified in relation to a spatially fixed coordinate system.

It would also be conceivable to only determine the path of the substrate holder covered between two points. In this case, although a spatially fixed coordinate system is dispensed with, a very precise control system is nonetheless required in order to be able to determine the distances covered very accurately.

Each method from the prior art mentioned requires relatively expensive and complicated electronic-mechanical systems, in order to be able to measure the position or the path covered of the substrate holder and therefore the structural positions on the substrate surface of a substrate. Furthermore, the travel paths of such systems are considerable. Due to the corresponding size, even the smallest temperature fluctuations have an influence on the thermal expansions and thus the component sizes of the components used.

In order to be able to measure structures, which are not simultaneously located in the viewing area of an optical system, on the substrate surface of a substrate, a relative movement must take place between the substrate and the optical system, in order to bring the structures into the viewing area of the optical system one after the other. For the most part, the substrate holder, on which the substrate is fixed, travels, whilst the optical systems are fixed. During the travel, the position of the substrate holder must be followed continuously. One therefore requires a reference system in relation to which the position of the substrate holder is specified. The position information of the substrate holder and thus of the substrate must take place very accurately, particularly in the nanometre range. This exact position information, particularly over travel distances of a plurality of centimetres, requires very accurate and therefore expensive measurement systems, particularly interferometers.

Embodiments of the present invention seek to specify a device and a method for measuring substrates, using which a more accurate and/or more efficient determination of the positions of structures or structural features on substrates is enabled.

According to a first aspect of the present invention, there is provided a mark field, having at least two location marks with information for the location of the respective location mark in the mark field, and at least one position mark, which is or can be assigned to one of the location marks.

According to a second aspect of the present invention, there is provided a device for determining X-Y positions of structural features of structures

arranged on a substrate, wherein the X-Y positions can be determined relatively to a mark field fixed with respect to the substrate, wherein the mark field is constructed according to the above aspect.

According to a third aspect of the present invention, there is provided a method for determining X-Y positions of structural features of structures arranged on a substrate, wherein the X-Y positions are determined relatively to a mark field fixed with respect to the substrate, which has at least two location marks with information for the location of the respective location mark in the mark field, and at least one position mark, which is or can be assigned to one of the location marks.

All combinations made up of at least two features specified in the description, the claims and/or the figures also fall within the scope of the invention. When value ranges are specified, values lying within the limits mentioned should also be disclosed as limit values and be claimable in any desired combination.

Embodiments of the invention are based on the idea of providing a mark field having

- at least two location marks with information for the location of the respective location mark in the mark field, and
- at least one position mark, which is or can be assigned to one of the location marks, for determining X-Y positions of structural features of structures on a substrate, particularly independently of a movement or position of a substrate holder.

The measurement according to embodiments of the invention of the structures of a substrate in further process steps in particular allows a more accurate and more efficient bonding process of two substrates to one another. If the measured structural positions do not correspond to the desired structural positions, a compensation of at least one of the two substrates takes place in particular prior to and/or during the bonding process.
In other words, substrate pairs are preferably formed according to selection criteria.