DESCRIPTION

TITLE OF INVENTION: PROCESSING APPARATUS, PROCESSING METHOD, AND MANUFACTURING METHOD OF SUBSTRATE

TECHNICAL FIELD

[0001]

The present invention relates to a processing apparatus, a processing method, and a manufacturing method of a substrate.

BACKGROUND ART

[0002]

Semiconductor package substrates are shifting from the trend of "More Than Moore" to the trend of System on a Chip (SoC) of integrating the system into one chip, and are being actively developed along this trend.

[0003]

Furthermore, the configuration of the semiconductor package substrate is becoming more complex and denser, and an apparatus using an excimer laser has been applied to the manufacture of a base substrate of the semiconductor package substrate.

[0004]

As the semiconductor package substrate becomes denser, the wiring of the semiconductor package substrate is also required to be highly precise, and the wiring is also becoming more multilayered. Such thinning and multi-layering of the wiring leads to narrower and more complex line-and-space (L&S). As the wiring width becomes narrower, wiring resistance tends to increase.

[0005]

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irradiation area on a portion of another substrate irradiation area.

[0063]

With such a processing method, it is possible to accurately perform a nearly uniform protrusions-and-recesses forming process across the area to be processed of the substrate. Therefore, with the processing method of this aspect, it is possible to accurately perform the minute protrusions-and-recesses forming process across the area to be processed of the substrate.

[0064]

Furthermore, the present invention provides, as a processing method of a third aspect, a processing method for forming minute protrusions and recesses on a surface of a substrate by ablation processing using irradiation energy of a laser beam, the method including:

providing a processing apparatus including a first optical function unit including a laser light source and a shaping optical system, a second optical function unit including a mask containing an effective area having a pattern corresponding to an area to be processed of the substrate, and a substrate stage that holds the substrate;

irradiating, in the first optical function unit, the shaping optical system with the laser beam in pulse from the laser light source to shape an irradiation shape of the laser beam into a rectangular shape;

irradiating, in the second optical function unit, a mask irradiation area with the laser beam that has passed through the first optical function unit, the mask irradiation area being a part of the effective area of the mask; and

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provided with a plurality of cylindrical lenses constituted by an X1 cylindrical lens 13, a Y1 cylindrical lens 14, an X2 cylindrical lens 15, and a Y2 cylindrical lens 16, and a collecting lens 17. The X1 cylindrical lens 13 and the X2 cylindrical lens 15 are disposed with a spacing twice a focal distance f1 thereof. The Y1 cylindrical lens 14 and the Y2 cylindrical lens 16 are also disposed with a spacing twice the focal distance thereof as shown in a lower part of FIG. 5.

[0155]

The laser beam 1 oscillated by the laser light source 11 shown in FIG. 1 has a non-uniform irradiation shape (beam profile) as shown in FIG. 5. Once the laser beam 1 having such an irradiation shape enters the shaping optical system 12, each component of the laser beam 1 is shaped according to positions in an X direction and a Y direction thereof. The lower part of FIG. 5 schematically shows how the component indicated by “2”, for example, is shaped through the cylindrical lenses 14 and 16. Each component of the laser beam 1 is shaped by the cylindrical lenses 13 to 16 and collected at a position spaced from the collecting lens 17 by a focal distance f2. By collecting each component, the laser beam 2 having a top-hat beam shape as shown in FIG. 5 is formed and output from the shaping optical system 12 as an output beam.

[0156]

By recombining the configuration of the cylindrical lenses in the X direction and the Y direction, it is possible to shape the beam shape into a square, a rectangle, or the like.

[0157]

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The processing method of the present invention is not limited to the method using the processing apparatus 100 of the first aspect described above.

[0198]

For example, the processing method of the second aspect of the present invention is a processing method for forming minute protrusions and recesses on a surface of a substrate by ablation processing using irradiation energy of a laser beam, the method including: allowing the laser beam shaped into a rectangular shape to pass through a mask to thereby irradiate the substrate with the laser beam so as to make a substrate irradiation area smaller than an area to be processed of the substrate; and performing, during processing operation on the substrate, a surface protrusions-and-recesses forming process on the area to be processed of the substrate while superimposing a portion of one substrate irradiation area on a portion of another substrate irradiation area.

[0199]

With such a processing method, irradiation of the laser beam is performed so as to make the substrate irradiation area smaller than the area to be processed of the substrate, and the surface protrusions-and-recesses forming process on the area to be processed of the substrate is performed while superimposing a portion of one substrate irradiation area on a portion of another substrate irradiation area, in other words, the superimposed irradiation is performed. Therefore, it is possible to accurately perform the nearly uniform protrusions-and-recesses forming process across the area to be processed of the substrate. Therefore, with the processing method of this aspect, it is possible to

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