The invention further allows an upward convex bending or deflection of the substrate; such a controlled convex bending is particularly relevant in photolithography processes which require a very close distance between mask and substrate in order to avoid inclusion of air and to support discharge of air.

The compensation of the substrate deflection may be adjusted based on the properties of the substrate by means of an exchangeable nozzle of different properties and/or a controllable nozzle in order to control the size and the shape of the gas cushion.

In accordance with a first aspect of the invention, method for supporting a substrate on a support is provided. The substrate has an inner area and an edge area surrounding the inner area. The support has an edge portion contacting the edge area of the substrate and an inner portion facing the exposed inner area of the substrate without mechanical contact. The method provides a gas cushion between the inner portion of the support and the substrate.

The invention is further exemplified as follows:

The (circular) diameter or (square) edge length of the substrate or wafer may be e.g. up to 1000 mm, e.g. 50 mm to 400 mm.

The thickness of the substrate or wafer may be e.g. up to 10 mm or higher, e.g. 50 µm to 1000 µm.

The types of the substrates or wafers may be selected from any material suitable for photolithographic processes, e.g. silicon, glass, GaAs, metals, alloys, or plastics; however, the invention may also be used in case of other materials if a deflection of a substrate supported at a peripheral portion should be avoided or if a specific deflection should be created - irrespective of the processes subsequently applied to the substrate.

As explained above, any suitable gaseous medium may be used for generating the gas cushion, e.g. nitrogen, pressurized air, or clean or noble gases.

The distance between the tip of the nozzle and the target position of the substrate depends on the expected deflection of the substrate and may be e.g. 10 µm to 1000 µm.

The diameter of the nozzle aperture may be e.g. 0.1 mm to 5 mm, preferably 500 µm to 1500 µm.

Embodiments of the invention will be further described with reference to the accompanying drawings:

Fig. 1(a) is a schematic cross section of a support or chuck with a substrate or wafer according to the invention;

Fig. 1(b) schematically shows the upwardly directed force generated by the dynamic gas cushion and acting on the substrate in the system of Fig. 1(a);

Fig. 2 shows test results of the wafer deflection depending on the gas flow for different wafer thicknesses;

CLAIMS

1. Method for supporting a substrate (6) on a support (1), said substrate (6) having an inner area (8) and an edge area (7) surrounding the inner area (8), said support (1) having an edge portion (2) contacting the edge area (7) of the substrate (6) and an inner portion (3) facing the exposed inner area (8) of the substrate (6) without mechanical contact, said method providing a gas cushion (9) between the inner portion (3) of the support (1) and the substrate (6).

2. The method of claim 1, wherein the contact between the edge area (7) of the substrate (6) and the edge portion (2) of the support (1) is provided by means of vacuum suction.

3. The method of claim 1 or 2, wherein the gas cushion (9) is generated by means of a nozzle (10) or purge supplied with a gas.

4. The method of claim 1, 2, or 3, wherein the gas cushion (9) is arranged coaxially to the support (1) and/or the substrate (6).

5. The method of any one of claims 1 to 4, wherein excess gas (12) from the gas cushion (9) is discharged from the support (1) via openings (11).

6. The method of any one of claims 1 to 5, wherein the upward directed force generated by the gas and acting on the downward facing surface of the substrate decreases from the location of the nozzle towards the edge portion (2) of the support and contributes to the compensation of the downward deflection of the substrate (6).

7. Apparatus for performing the method of any one of claims 1 to 6, comprising:

(a) a horizontal support (1) having

(a1) an edge portion (2) for supporting the substrate (6) at its edge area (7),

(a2) an inner portion (3) being lower (distance d) than the upper surface of the edge portion (2), and

(b) means for providing a gas cushion (9) between the inner portion (3) of the support (1) and the inner area (8) of the substrate (6).

8. Apparatus according to claim 7, wherein the gas cushion providing means is arranged coaxially to the support (1) and/or the substrate (6).

9. Apparatus according to claim 7 or 8, wherein the gas cushion providing means comprises a nozzle or purge (10).

10. Apparatus according to claims 7, 8, or 9, wherein the edge portion (2) of the support (1) comprises apertures (4) connected to a vacuum means (V) for vacuum suction of the substrate edge area (7) to the edge portion (2) of the support (1).

11. Apparatus according to any one of claims 7 to 10, comprising openings (11) arranged in the chuck (1) for discharging excess gas from the gas cushion (9).

12. Apparatus according to claim 11, wherein the openings (11) for discharging gas are arranged close to the edge portion (2) of the chuck (1).