In a second aspect, the present disclosure provides for an end effector for holding substrates, comprising a carrier and at least one suction apparatus in accordance with the first aspect, which is fastened to the carrier.

In order to be able to fasten the main body of the suction apparatus in a secure manner to the end effector, the carrier can have a fastening opening, through which the base portion of the main body extends, wherein the fastening opening has a smaller diameter than the fastening portion, and wherein the fastening portion has a larger diameter than the base portion. In this manner, the main body of the suction apparatus can easily be fastened to the end effector.

Furthermore, the diameter of the fastening opening can also be larger than, or approximately the same size as, the diameter of the fastening portion. In this case, the fastening portion can be inserted and optionally adhered into fastening opening.

Preferably, the sealing lip is provided on the side of the fastening opening facing away from the fastening portion, wherein the suction apparatus is fixed in the fastening opening by means of the sealing lip and the fastening portion.

In the carrier at least one fluid channel, in particular a vacuum channel, is provided, wherein the at least one connection channel of the fastening portion is in fluid communication with the at least one fluid channel of the carrier, whereby negative pressure can be produced in the region of the recesses.

In one embodiment of the disclosure, the carrier has at least two layers, wherein the main body, in particular the fastening portion, is fastened between the two layers. As a result, the main body can be fastened securely to the carrier in a simple manner.

In a third aspect, the present disclosure provides for a method of producing an end effector, comprising the steps of:

a) providing a first layer of a carrier of the end effector which has a fastening opening,

b) inserting the main body of a suction apparatus into the fastening opening from a first side of the first layer, the main body having a base portion and a fastening portion,

c) fastening a second layer of the carrier of the end effector to the first layer and/or the main body, in particular from the first side,

d) clamping the fastening portion of the suction apparatus between the first layer and the second layer, and

e) fastening a sealing lip to the main body from a second side of the first layer opposite the first side so that the sealing lip also serves to fasten the suction apparatus to the carrier.

The first side is e.g. the topside of the first layer and of the carrier, i.e. the side on which the substrate is picked up under conditions of normal usage. In this way, the suction apparatus can be fastened to the carrier of the end effector in a simple and yet reliable manner.

Preferably, the sealing lip is fastened to the main body from a second side of the first layer opposite the first side so that the sealing lip also serves to fasten the suction apparatus to the carrier. The second side is e.g. the bottom side of the first layer or of the carrier.

Further features and advantages of the invention will be apparent from the following description and the enclosed drawings to which reference is made. In the drawings:

- Figure 1 shows a perspective view of an end effector in accordance with the invention comprising a suction apparatus in accordance with the invention, as well as a cartridge.

- Figure 2 shows a sectional view of the end effector of figure 1 in the region of one of the suction apparatuses in accordance with the invention.
- Figure 3 shows a sectional view of a main body of a suction apparatus in accordance with the invention,
- Figure 4 shows a perspective view of the main body of figure 3, and
- Figure 5 shows a bottom view of the main body of figure 3.

Figure 1 illustrates an end effector 10 in an empty cartridge 11 for substrates. End effectors 10 are components of robots at the end of a kinematic chain.

The end effector 10 can be fastened to a robot arm (not shown) for moving substrates, e.g. wafers, and in the embodiment shown is a holder. However, it could also be a gripper.

The end effector 10 has a carrier 12 and two suction apparatuses 14 provided on the carrier 12.

Claims

1. Suction apparatus for an end effector for holding substrates, comprising a main body which has a through-channel and a contact surface, and a sealing lip which surrounds the contact surface on an edge side, wherein the contact surface has an edge and at least one recess, in particular a suction groove, wherein the through-channel is connected with at least one recess,

wherein the main body has a conical or cylindrical base portion, of which the end side constitutes the contact surface,

wherein the main body has a fastening portion which adjoins the base portion on the end side of the base portion facing away from the contact surface,

wherein in the fastening portion at least one connection channel is provided which is in fluid communication with the through-channel and extends from the edge of the fastening portion,

characterised in that starting from the through-channel the at least one recess becomes flatter and in particular transitions into the contact surface.

2. Suction apparatus as claimed in claim 1, characterised in that the at least one recess terminates in front of the edge of the contact surface.

3. Suction apparatus as claimed in any one of the preceding claims, characterised in that the sealing lip is fastened to the base portion and extends as far as the contact surface or beyond a plane defined by the contact surface.

4. Suction apparatus as claimed in any one of the preceding claims, characterised in that the base portion has, on its circumference, an annular groove in which the sealing lip is fastened.

5. Suction apparatus as claimed in claim 4, characterised in that the annular groove extends obliquely with respect to a radial plane of the base portion.

6. End effector for holding substrates, comprising a carrier and at least one suction apparatus as claimed in any one of the preceding claims, which is fastened to the carrier.

7. End effector as claimed in claim 6, characterised in that the carrier has a fastening opening, through which the base portion of the main body extends, wherein the fastening opening has a smaller diameter than the fastening portion, and wherein the fastening portion has a larger diameter than the base portion.

8. End effector as claimed in claim 7, characterised in that the sealing lip is provided on the side of the fastening opening facing away from the fastening portion, wherein the suction apparatus is fixed in the fastening opening by means of the sealing lip and the fastening portion.

9. End effector as claimed in claim 7 or 8, characterised in that in the carrier at least one fluid channel, in particular a vacuum channel, is provided, wherein the at least one connection channel of the fastening portion is in fluid communication with the at least one fluid channel of the carrier.

10. End effector as claimed in any one of claims 6 to 9, characterised in that the carrier has at least two layers, wherein the main body, in particular the fastening portion, is fastened between the two layers.

11. Method of producing an end effector, comprising the steps of:

a) providing a first layer of a carrier of the end effector which has a fastening opening,

b) inserting the main body of a suction apparatus into the fastening opening from a first side of the first layer, the main body having a base portion and a fastening portion,

c) fastening a second layer of the carrier of the end effector to the first layer and/or the main body, in particular from the first side,

d) clamping the fastening portion of the suction apparatus between the first layer and the second layer, and

e) fastening a sealing lip to the main body from a second side of the first layer opposite the first side so that the sealing lip also serves to fasten the suction apparatus to the carrier.