

MOLDING DIE, RESIN MOLDING APPARATUS, AND METHOD FOR PRODUCING A RESIN MOLDED PRODUCT

CROSS-REFERENCE TO RELATED APPLICATION

- 5 This application claims priority from Japanese Patent Application No. 2018-008487 filed on January 22, 2018. The entire subject matter of the Japanese Patent Application is incorporated herein by reference.

BACKGROUND OF THE INVENTION

10 1. Field of the Invention

[0001] The present invention relates to a molding die, a resin molding apparatus, and a method for producing a resin molded product.

2. Description of Related Art

- 15 [0002] In recent years, it has been proposed to enlarge a region to be resin-molded in the technique of resin molding a substrate.

- [0003] For example, according to the description of JP 2017-24398 A, the mold die (molding die) described in the document prevents a workpiece (a semiconductor wafer, a rectangular substrate, etc.) held on the die clamp surface from being misaligned or
20 dropped and allows the resin package portion (a region to be resin-molded) to be enlarged.

SUMMARY OF THE INVENTION

[0004] However, in the configuration of the mold die (molding die) of JP 2017-24398 A, the resin package portion (a resin to be resin-molded) cannot be made sufficiently large.

Specifically in JP 2017-24398 A, as shown in FIGs. 9 and 10 of the document, it is

5 necessary to clamp the entire outer peripheral end portion of the workpiece by the lower die movable clasper 6g. Thus, the size of the resin package portion is limited.

[0005] Hence, the present invention is intended to provide a molding die, a resin molding apparatus, and a method for producing a resin molded product, capable of ensuring a large area of a region to be resin-molded in an object to be molded.

10 [0006] In order to achieve the aforementioned object, the molding die of the present invention includes: an upper die; and a lower die, wherein the upper die is capable of adsorbing an object to be molded, the lower die includes a lower die bottom member, a lower die side member, and molding object drop prevention block, a lower die cavity is formed by a space surrounded by the lower die bottom member and the lower die side

15 member, and the molding object drop prevention block is provided on a part of an end portion of the lower die side member facing the lower die cavity and is movable up and down.

[0007] The resin molding apparatus of the present invention includes the molding die of the present invention.

20 [0008] The method for producing a resin molded product of the present invention

includes depressurizing, using the molding die of the present invention or the resin molding apparatus of the present invention, the inside of the lower die cavity in a state where an object to be molded is adsorbed to the upper die and the molding object drop prevention block is in contact with at least one of the upper die or the object to be molded; clamping the upper die and the lower die; and resin molding the object to be molded using the lower die cavity.

[0009] The present invention can provide a molding die, a resin molding apparatus, and a method for producing a resin molded product, capable of ensuring a large area of a region to be resin-molded in an object to be molded.

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BRIEF DESCRIPTION OF THE DRAWINGS

[0010] [FIG. 1] FIG. 1 is a perspective view schematically showing a configuration of a lower die in a molding die according to the first embodiment.

[FIG. 2] FIGs. 2A and 2B are perspective views of a part of the lower die in FIG.

15 2. FIG. 2A shows an unclamped state, and FIG. 2B shows a clamped state.

[FIG. 3] FIG. 3 is a partial cross-sectional view showing a structure of a portion to which a molding object drop prevention block is attached in the lower die in FIG. 1.

[FIG. 4] FIG. 4 is a partial cross-sectional perspective view of an upper die in a molding die according to the first embodiment.

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[FIG. 5] FIG. 5 is a partial cross-sectional view of a molding die in

depressurizing according to the first embodiment.

[FIG. 6] FIGs 6A and 6B are partial cross-sectional views of a molding die according to the first embodiment in a clamped state.

[FIG. 7] FIG. 7 is a cross-sectional view schematically showing one step in the method for producing a resin molded product using the molding die according to the first embodiment.

[FIG. 8] FIG. 8 is a cross-sectional view schematically showing another step in the method for producing a resin molded product of FIG. 7.

[FIG. 9] FIG. 9 is a cross-sectional view schematically showing yet another step in the method for producing a resin molded product of FIG. 7.

[FIG. 10] FIG. 10 is a cross-sectional view schematically showing yet another step in the method for producing a resin molded product of FIG. 7.

[FIG. 11] FIG. 11 is a cross-sectional view schematically showing yet another step in the method for producing a resin molded product of FIG. 7.

[FIG. 12] FIG. 12 is a cross-sectional view schematically showing yet another step in the method for producing a resin molded product of FIG. 7.

[FIG. 13] FIGs. 13A and 13B are schematic views showing the structure of a lower die in a molding die according to the second embodiment. FIG. 13A is a plane view (top view), and FIG. 13B is a side view.

[FIG. 14] FIG. 14 is a perspective view of the lower die of FIGs. 13A and 13B.

[FIG. 15] FIGs. 15A to 15C are schematic views showing the structure of a portion to which a molding object drop prevention block is attached in the lower die of FIGs. 13 and 14 and the motion of the lower die. FIGs. 15A and 15B are partial cross-sectional views, and FIG. 15C is a partial plane view.

5 [FIG. 16] FIGs. 16A and 16B are partial perspective views schematically showing a modification of a lower die in the molding die according to the second embodiment. FIG. 16A shows an unclamped state, and FIG. 16B shows a clamped state.

[FIG. 17] FIG. 17 is a cross-sectional view schematically showing the clamped state in the molding die according to the second embodiment.

10 [FIG. 18] FIG. 18 is a cross-sectional view schematically showing the clamped state in the modification of the molding die according to the second embodiment.

[FIG. 19] FIG. 19 is a plane view schematically showing the structure of a resin molded product obtained by resin molding with the molding die according to the second embodiment.

15 [FIG. 20] FIG. 20 is a plane view schematically showing the configuration of a resin molding apparatus according to the third embodiment.

DETAILED DESCRIPTION OF THE INVENTION

[0011] Hereinafter, the present invention will be described by way of illustrative
20 embodiments with reference to the drawings. The present invention, however, is not

limited by the following description.

[0012] In the molding die of the present invention, the molding object drop prevention block may be attached to the lower die side member by an elastic member, for example.

[0013] In the molding die of the present invention, the upper die has a projection that
5 projects downward, for example, and the projection may be disposed so as to surround the outer periphery of a portion of the upper die capable of adsorbing the object to be molded.

[0014] In the molding die of the present invention, the lower die side member may have a release film holding portion that can hold a release film on the outer side of the molding object drop prevention block, for example.

10 [0015] In the method for producing a resin molded product of the present invention, the depressurizing may be performed in a state where the object to be molded is supported by the molding object drop prevention block and the upper die, for example.

[0016] In the method for producing a resin molded product of the present invention, the lower die side member in the molding die may have a release film holding portion that
15 can hold a release film on the outer side of the molding object drop prevention block, the method may further include causing the release film holding portion to hold a release film, and the depressurizing may be performed in a state where the release film holding portion holds the release film, for example.

[0017] In the present invention, the resin molded product is not limited to particular
20 products and may be, for example, a resin molded product obtained by merely molding a

resin or a resin molded product obtained by resin encapsulation of a part such as a chip.

In the present invention, the resin molded product may be, for example, an electronic component. Alternatively, in the present invention, the resin molded product may be, for example, a finished product or a semi-finished product.

5 [0018] In the present invention, the “resin molding” or the “resin encapsulation” means, for example, a state where the resin is cured (solidified). However, in the present invention, the “resin molding” or the “resin encapsulation” is not limited to the meaning described above and may be, for example, a semi-cured (semi-solidified) state where the resin is not completely cured (solidified). The semi-cured (semi-solidified) state may be,
10 for example, a state where the resin is cured (solidified) to such an extent that the resin can be released from the molding die or transferred together with the molding die.

[0019] In the present invention, the resin material before molding and the resin after molding are not limited to particular resin materials and particular resins and may be, for example, thermosetting resins such as an epoxy resin and a silicone resin and
15 thermoplastic resins. The resin material before molding and the resin after molding may be composite materials partially containing thermosetting resins or thermoplastic resins.

In the present invention, examples of the form of the resin material before molding include granular resins, flowable resins, sheet-like resins, and tablet-like resins, and powder resins. In the present invention, the flowable resin is only required to be a resin
20 having fluidity and is not limited to particular resins, and examples thereof include liquid

resins and molten resins. In the present invention, the liquid resin is, for example, a liquid at room temperature or a resin having fluidity. In the present invention, the molten resin is, for example, a resin in a form of liquid or a resin having fluidity by melting. The form of the resin is only required to be capable of being supplied to a cavity of the molding die or a pot and may be another form.

[0020] The "electronic component" can refer to a chip before resin encapsulation or a resin encapsulated chip. However, a mere "electronic component" in the present invention refers to an electronic component being the chip encapsulated in a resin (a completed electronic component), unless otherwise mentioned. In the present invention, a "chip" refers to a chip before resin encapsulation and can be, for example, specifically an IC, a semiconductor chip, or a chip such as a semiconductor element for power control.

In the present invention, a chip before resin encapsulation is referred to as a "chip" as a matter of convenience in order to differentiate from an electronic component after resin encapsulation. However, the "chip" in the present invention is only required to be an electronic component before resin encapsulation and is not limited to particular electronic components and may not be a chip-like electronic component.

[0021] In the present invention, a "flip chip" means an IC chip having a bump-like protruding electrode called a bump on an electrode (bonding pad) on the front surface of the IC chip, or a chip form thereof. This chip is mounted on a wiring portion such as a printed circuit board in a downward direction (face-down) manner. The flip chip is used,

for example, as one of a chip for wireless bonding or a mounting method.

[0022] In the present invention, the object to be molded is not limited to particular objects and can be, for example, a substrate for the resin molded product and a support member. Examples of the object to be molded include support members capable of

5 supporting semiconductor chips, chip-like electronic components, or films (including conductive films, insulating films, and semiconductor films). More specifically,

examples of the support member include lead frames, substrates, interposers, semiconductor substrates (silicon wafers), metal substrates, glass substrates, ceramic substrates, resin substrates, and wiring substrates. Examples of the support member

10 further include substrates, resin substrates, wiring substrates, interposers such as L/F (lead frame). The substrate (also referred to as a workpiece or interposer) is not limited to particular substrates, and examples thereof include lead frames, wiring substrates, wafers, and ceramic substrates. In the present invention, the object to be molded however is not limited to these and can be any object. The shape of the object to be molded is not

15 limited to particular shapes. For example, the surface shape of the object to be molded may be a circular shape or a quadrangle shape. Moreover, the object to be molded may or may not include wiring. The object to be molded may further include a carrier of a plate-like member used in FO-WLP (Fan Out Wafer Level Package) or FO-PLP (Fan Out Panel Level Package), for example. In the present invention, a member such as a chip

20 may or may not be mounted on one or both surfaces of the object to be molded. The

method for mounting the chip is not limited to particular methods, and examples thereof include wire bonding and flip chip bonding.

[0023] In the present invention, for example, a resin molded product may be produced by resin molding only one or both surfaces of the object to be molded. Alternatively, a

5 resin molded product (e.g., an electronic component) may be produced by resin encapsulating (resin molding) a part (e.g., a chip or a flip chip) mounted on one or both surfaces of the object to be molded. The application of a resin molded product produced by the present invention is not limited to particular applications but may be, for example, a high-frequency module substrate for a portable communication terminal, a module
10 substrate for power control, and a substrate for equipment control.

[0024] In the present invention, "embedding" includes "placing" or "fixing", and in the present invention, "mounting" includes "fixing". In the present invention, "placing" includes "fixing".

[0025] In the present invention, the molding die is not limited to particular dies and can
15 be, for example, a gold die or a ceramics die.

[0026] In the present invention, for example, compression molding can be used as a method for producing a resin molded product. Moreover, for example, a compression molding apparatus can be used as a resin molding apparatus.

[0027] The examples of the present invention are described below with reference to the
20 drawings. Each drawing is schematically illustrated by appropriately omitting,

exaggerating, and the like for convenience in explanation.

First Embodiment

[0028] In the present embodiment, an example of a molding die and a resin molding
5 apparatus and an example of a method for producing a resin molded product using the
same will be described.

[0029] FIG. 1 is a perspective view schematically showing a configuration of a lower
die in a molding die used in the present embodiment. As shown in FIG. 1, this lower die
200 includes a lower die bottom member 202, a lower die side member 201, and molding
10 object drop prevention blocks (substrate drop prevention blocks) 211. The lower die
side member 201 is disposed so as to surround the lower die bottom member 202. A
lower die cavity is formed by a space surrounded by the lower die bottom member 202
and the lower die side member 201. The lower die side member 201 is formed of a
lower die side member (A) 201A and a lower die side member (B) 201B. The lower die
15 side member (A) 201A is placed on the upper surface of the lower die side member (B)
201B.

[0030] Each molding object drop prevention block 211 is provided on a part of an end
portion of the lower die side member (A) 201A facing the lower die cavity and is
movable up and down. A bolt fixing through hole 212 and a spring storage hole 213 are
20 provided at the respective positions of the lower die side member (A) 201A, at which the

molding object drop prevention block 211 is attached. As mentioned below, the bolt fixing through hole 212 and the spring storage hole 213 are provided to fix each molding object drop prevention block 211 to the lower die side member 201 by a bolt and a spring (elastic member). In FIG. 1, the lower die bottom member 202 has a circular shape.

5 However, in the present invention, the shape of the lower die bottom member is not limited to a circle, may be any shape, and may be, for example, a rhombus (a square or a rectangle). Moreover, in the lower die 200 of FIG. 1, the number of molding object drop prevention blocks 211 is four, and the molding object drop prevention blocks 211 are provided on the circumference of the lower die side member (A) 201A at equal intervals.

10 In FIG. 1, as a matter of convenience of illustrating the bolt fixing through hole 212 and the spring storage hole 213, two out of four molding object drop prevention blocks 211 are not shown. In the molding die of the present invention, the number of molding object drop prevention blocks is not limited to four and may be any number. For example, the number of molding object drop prevention blocks may be, for example, one
15 or any number of two or more. For the effect of preventing an object to be molded from dropping and ensuring a large area of a region to be resin-molded, the number of molding object drop prevention blocks is preferably two or more, more preferably three or more.

[0031] The lower die side member (A) 201A further has a release film adsorption groove 205 on the upper surface thereof on the outer side of the molding object drop
20 prevention blocks 211. The release film adsorption groove 205 can hold the release film

by adsorbing and constitutes a release film holding portion of the lower die side member 201.

[0032] FIGs. 2A and 2B are perspective views showing the configurations of the molding object drop prevention block 211 and the periphery thereof in the lower die 200

5 of FIG. 1. FIG. 2A shows an unclamped state, and FIG. 2B shows a clamped state. As mentioned above, the molding object drop prevention block 211 is movable up and down.

As shown in FIG. 2A, the molding object drop prevention block 211 in the unclamped state is lifted and protrudes from the upper surface of the lower die side member (A)

201A. This thus allows the molding object drop prevention block 211 to support an

10 object to be molded and to prevent the object to be molded from dropping, as mentioned below. On the other hand, as shown in FIG. 2B, the molding object drop prevention

block 211 in the clamped state is lowered and does not protrude from the upper surface of the lower die side member (A) 201A. Thus, the upper surfaces of the lower die side

member (A) 201A and the molding object drop prevention block 211 are flush with each

15 other. Please note that the portion at the upper end of the molding object drop

prevention block 211, facing the lower die cavity 203, slightly protrudes from the upper surface of the lower die side member (A) 201A. This portion is not resin-molded (resin

encapsulated) as mentioned below.

[0033] FIG. 3 is a partial cross-sectional view showing a structure of a portion to which

20 a molding object drop prevention block 211 is attached in the lower die 200 in FIG. 1.

As shown in FIG. 3, a spring (elastic member) 217 is disposed in the spring storage hole (elastic member storage hole) 213 of the lower die side member (B) 201B. Moreover, the lower portion of the molding object drop prevention block 211 is provided with a hole, and the upper portion of the spring 217 is placed in the hole. Accordingly, the spring 217 is disposed to be sandwiched between the molding object drop prevention block 211 and the lower die side member (B) 201B. The molding object drop prevention block 211 is attached to the lower die side member (B) 201B by the bolt 214, a washer 215, and a collar 216 in the bolt fixing through hole 212. The molding object drop prevention block 211 is movable up and down by moving the collar 216 up and down in the bolt fixing through hole 212. As shown in FIG. 3, the molding object drop prevention block 211 in the unclamped state is in the lifted state by a stretching force of the spring 217. In this state, the washer 215 is engaged in the upper portion of the bolt fixing through hole 212, whereby the molding object drop prevention block 211 does not come free from the lower die side member (B) 201B.

[0034] FIG. 4 is a partial cross-sectional perspective view showing a partial configuration of the upper die 100 used together with the lower die 200 in the molding die of the present embodiment. As a matter of convenience of illustration, FIG. 4 is inversed upside down from the use of the upper die 100. As shown in FIG. 4, the upper die 100 includes an upper die side member (upper die outer circumferential member) 101 and an upper die upper member (upper die cavity member) 102. The upper die upper

member 102 is provided with an adsorption hole 106. As shown in FIG. 4, a substrate (object to be molded) 1 can be adsorbed by suction from the adsorption hole 106. The upper die side member 101 is disposed so as to surround the upper die upper member 102.

A gap (clearance) and a step 105 are formed between the upper die upper member 102

5 and the upper die side member 101. With this step, a cavity (upper die cavity)

surrounded by the upper die upper member 102 and the upper die side member 101 is

formed, and the substrate 1 can be adsorbed in this cavity, as mentioned above. A

projection (clamp margin) 103 that projects downward is formed in the lower surface

(upper surface in FIG. 4) of the upper die side member 101, and the lower surface (upper

10 surface in FIG. 4) is a clamping surface. The projection 103 is disposed so as to

surround the outer periphery of a portion (upper die upper member 102) of the upper die

100, which can adsorb the substrate (object to be molded) 1. A portion of the upper die

side member 101 other than the projection 103 forms a depression 104 that is a bearing

pressure clearance portion. The lower surfaces of the upper die side member 101 and

15 the upper die upper member 102 may be flush with each other without providing the

upper die side member 101 with the projection 103, and a depression 104 that is a bearing

pressure clearance portion may be formed in this case.

[0035] In the present embodiment, the substrate (object to be molded) 1 has a circular shape, and with this shape, the lower die bottom member 202 and the upper die upper

20 member 102 each has a circular shape. However, in the present invention, the shape of

the object to be molded (substrate) is not limited to a circle, may be any shape, and may be, for example, a rhombus (a square or a rectangle). The shapes of the lower die bottom member 202 and the upper die upper member 102 are also not limited to particular shapes and may be a shape corresponding to the shape of the substrate (object to be molded) 1. The substrate (object to be molded) 1 is not limited to particular objects, and as mentioned above, examples of the support member include lead frames, substrates, interposers, semiconductor substrates (silicon wafers), metal substrates, glass substrates, ceramic substrates, resin substrates, and wiring substrates. The substrate 1 may be, for example, a circular silicon wafer, a circular metal substrate or glass substrate.

[0036] FIG. 5 is a partial cross-sectional view of a part of a molding die in the depressurizing step of the method for producing a resin molded product using a molding die in the present embodiment. As shown in FIG. 5, in the depressurizing step, the end portion of the substrate 1 is being fixed (clumped) between the molding object drop prevention block 211 and the upper die side member 101. In this state, as shown in FIG.

5, a gap is formed between the lower die side member (A) 201A and the upper die side member 101. The inside of the lower die cavity can be depressurized by sucking gas inside the lower die cavity from this gap. With this configuration of FIG. 5, even when the degree of vacuum inside the lower die cavity approaches the degree of vacuum inside the molding object absorption portion (inside the adsorption hole 106 of the upper die upper member 102), the substrate (object to be molded) 1 can be prevented from dropping

by the molding object drop prevention block 211.

[0037] FIGs. 6A and 6B are partial cross-sectional views of a molding die of the present embodiment in a clamped state. FIG. 6A is a longitudinal cross-sectional view of a portion in which the molding object drop prevention block 211 is provided. FIG. 6B is a

5 longitudinal cross-sectional view of a portion in which the molding object drop prevention block 211 is not provided. As shown in FIG. 6A, in the clamped state, the molding object drop prevention block 211 in the clamped state is lowered and does not protrude from the upper surface of the lower die side member (A) 201A. Thus, the upper surfaces of the lower die side member (A) 201A and the molding object drop
10 prevention block 211 are flush with each other. At that time, as shown in FIG. 6A, the substrate 1 is fixed (clumped) by being sandwiched between the molding object drop prevention block 211 and the upper die upper member (upper die cavity member) 102. This clamping prevents flushing of the resin from the back side, generated when the resin enters between the substrate 1 and the upper die cavity member 102. As shown in FIG.
15 6B, the substrate 1 is not clamped by the lower die side member (A) 201A in the part where the molding object drop prevention block 211 is not provided. Therefore, in this part, resin molding (also referred to as molding or resin encapsulation) can be performed up to the peripheral edge of the substrate 1. Furthermore, since there is a gap (clearance) between the substrate 1 and the upper die side member (upper die outer circumferential
20 member) 101, the resin can enter this gap and resin molding can be performed up to the

side surface of the substrate 1. In the present embodiment, the part where the molding object drop prevention block 211 is in contact with the substrate 1 is not resin-molded.

[0038] Next, FIGs. 7 to 12 are step cross-sectional views schematically showing the configuration of the molding die of the present embodiment and a part of the resin

5 molding apparatus, and the overview of the method for producing a resin molded product of the present embodiment using the same.

[0039] First, FIG. 7 is a cross-sectional view showing an overview of the configuration of the molding die 1000 of the present embodiment. A molding die 1000 includes, as mentioned above, an upper die 100 and a lower die 200. FIGs. 7 to 12 show the

10 structures of the upper die 100 and the lower die 200 in a simplified manner as described below, for the sake of convenience of illustration.

[0040] As shown in FIG. 7 and as described for FIG. 4, the upper die 100 includes an upper die side member (upper die outer circumferential member) 101 and an upper die upper member (upper die cavity member) 102. The upper die upper member 102 is

15 provided with an adsorption hole 106. As described below, a substrate (object to be molded) 1 can be adsorbed by suction from the adsorption hole 106. As shown in FIG.

7, the upper die side member (upper die outer circumferential member) 101 is provided to surround the upper die upper member (upper die cavity member) 102. As shown in FIG.

7 and as described for FIG. 4, a step is formed between the upper die upper member 102

20 and the upper die side member 101. With this step, a cavity (upper die cavity)

surrounded by the upper die upper member 102 and the upper die side member 101 is formed, and the substrate 1 (object to be molded) can be adsorbed in this cavity, as mentioned below. For the sake of convenience of illustration, FIGs. 7 to 12 show the configurations of the upper mold 100 in a simplified manner, and illustration of the projection 103 and the depression 104 of the upper die side member 101 shown in FIG. 4 is omitted.

[0041] As described for FIGs. 1 to 3, this lower die 200 includes a lower die bottom member 202, a lower die side member 201, and molding object drop prevention blocks (substrate drop prevention blocks) 211. The lower die side member 201 is disposed so as to surround the lower die bottom member 202. A lower die cavity 203 is formed as shown in FIG. 7 by a space surrounded by the lower die bottom member 202 and the lower die side member 201. The molding object drop prevention block 211 is provided on a part of an end portion of the lower die side member 201 facing the lower die cavity 203. The spring (elastic member) 217 is disposed between the molding object drop prevention block 211 and the lower die side member 201. The spring 217 is stretchable, whereby the molding object drop prevention block 211 can move up and down. The lower die side member 201 has a release film adsorption groove 205 on the upper surface thereof on the outer side of the molding object drop prevention blocks 211. The release film adsorption groove 205 can hold the release film by adsorbing and constitutes a release film holding portion of the lower die side member 201. FIGs. 7 to 12 show the

configurations of the lower die 200 in a simplified manner for the sake of convenience of illustration. That is, first, the lower die side member 201 is integrally illustrated without dividing into a lower die side member (A) 201A and a lower die side member (B) 201B.

Moreover, illustration of the bolt fixing through hole 212, the spring storage hole 213, the bolt 214, the washer 215, and the collar 216 shown in FIG. 3 are omitted in FIGs. 7 to 12.

For the sake of convenience of illustration and description, the cross section of the portion in which the molding object drop prevention block 211 is provided is shown on the right side, and the cross section of the portion in which the molding object drop prevention block 211 is not provided is shown on the left side of each of FIGs. 7 to 12.

[0042] The lower die bottom member 202 and the lower die side member 201 are disposed on a lower die base plate (base, not shown). The lower die bottom member 202 is fixed directly on the upper surface of the lower die base plate. The lower die side member 201 is fixed directly on the upper surface of the lower die base plate via an elastic member (not shown, e.g., a spring). Accordingly, the lower die side member 201 is movable up and down with respect to the lower die base plate.

[0043] The method for producing a resin molded product using the molding die and the resin molding apparatus of FIG. 7 can be performed, for example, as shown in FIGs. 8 to 12.

[0044] First, as shown in FIG. 8, the substrate (object to be molded) 1 is sucked from the adsorption hole 106 of the upper die upper member (upper die cavity member) 102

toward the direction indicated in an arrow V1 using a suction mechanism (not shown, e.g., a pump), thereby being adsorbed to the lower surface of the upper die upper member (upper die cavity member) 102. Chips 2 are embedded (fixed) on the lower surface of the substrate 1 (surface opposite to the surface adsorbed to the upper die upper member 102).

[0045] As shown in FIG. 8, while a granular resin (resin material) 20a is being placed on a release film 40, the granular resin (resin material) 20a is supplied (placed) into a lower die cavity 203 (resin material supply step). Then, the release film 40 is sucked from the release film absorption groove 205 toward the direction indicated by an arrow

V2 (toward the outside of the lower die 200) using another suction mechanism (not shown, e.g., a pump). In the above-described manner, the release film absorption groove (release film holding portion) 205 holds the release film 40. Accordingly, as shown in FIG. 8, a cavity surface of the lower die cavity 203 is coated with the release film 40, and the granular resin (resin material) 20a is being placed on the release film 40.

The release film 40 may be transferred to the lower die cavity 203 using a transfer mechanism (not shown) while the granular resin (resin material) 20a is being placed on the release film 40, for example. At that time, the lower die 200 may be entirely heated using a heating mechanism (heater, not shown) prior to supplying the release film 40 and the granular resin 20a. A method for supplying the granular resin 20a on the release film

40 is not limited to particular methods, and for example, the granular resin 20a may be

supplied on the release film 40 while weighing an appropriate amount of the granular resin 20a using a weighing mechanism (not shown).

[0046] Although the resin material 20a is a granular resin in FIG. 8, the resin material 20a is not limited thereto and can be any resin material, as mentioned above. The resin

5 material 20a may be, for example, a solid resin material such as power, powdery, granular, and sheet-like resin materials or may be, as mentioned above, a liquid resin.

Alternatively, the resin material 20a may be, for example, a thermosetting resin such as an epoxy resin and a silicone resin or a thermoplastic resin, or may further contain an additive.

10 [0047] In FIGs. 8 to 12, a release film 40 is supplied into the lower die cavity 203, and a resin material 20a is then supplied into the lower die cavity 203 coated with the release film 40. The present invention, however, is not limited to this, and for example, the resin material 20a may be placed (supplied) on the release film 40, and the release film 40 and the resin material 20a may then be conveyed to coat the lower die cavity 203 with the
15 release film 40. In the above-described manner, the resin material 20a can be supplied to the inside of the lower die cavity 203 coated with the release film 40. In the case where the resin material 20a is placed on the release film 40 outside of the lower die cavity 203, the resin material 20a is preferably a liquid resin or a sheet-like resin to prevent the resin material 20a from spilling out, for example. The present invention is
20 not limited to the example using the release film, and the release film may not be used, for

example.

[0048] Next, as shown in FIG. 9, the resin material 20a is heated by the heat of the lower die 200 heated by the heating mechanism (heater, not shown) to form a molten resin (flowable resin) 20b.

5 [0049] Thereafter, as shown in FIG. 10, the lower die 200 is lifted in the direction indicated by the arrow X1 by a drive mechanism (not shown) provided in the lower die 200. In the above-described manner, the molding object drop prevention block 211 is brought into contact with the upper die. In this state, an end of the substrate 1 is fixed (clamped) by being sandwiched between the molding object drop prevention block 211
10 and the upper die upper member 101, as also shown in FIG. 5. In this state, the inside of the lower die cavity 203 is depressurized by a depressurization mechanism (not shown, e.g, a suction pump) from gap formed between the upper surface of the lower die side member 201 on which the molding object drop prevention block 211 is not provided and the upper die 100 (depressurizing step).

15 For example, in the case where the lower surface of the upper die side member 101 is configured to be flush with the lower surface of the upper die upper member 102 without providing a projection 103 on the upper die side member 101 (see FIG. 4), the molding object drop prevention block 211 may be brought into contact with the substrate 1 without contacting the upper die. Therefore, in the depressurizing step, the molding
20 object drop prevention block is only required to be in contact with at least one of the

upper die or an object to be molded.

[0050] Then, the lower die 200 is further lifted to clamp the upper die 100 and the lower die 200 (clamping step). Specifically, first, the entire lower die 200 is further lifted to bring the upper surface (upper end surface) of the lower die side member 201 on which the molding object drop prevention block 211 is not provided into contact with the upper die 100. Thereafter, the lower die 200 is further lifted, so that the elastic member (elastic body) connecting to the lower die base plate and the lower die side member 201 is shrunk. Accordingly, the lower die bottom member 202 is relatively pushed up relative to the lower die side member 201. In this step, the chip 2 embedded in the lower surface (embedding surface) of the substrate 1 and the embedding surface are immersed in the flowable resin 20b.

[0051] Then, the clamped state is maintained for a period of time necessary for solidification of the flowable resin 20b. Thus, as shown in FIG. 11, the flowable resin 20b in the lower die cavity 203 is solidified into a cured resin (encapsulation resin) 20.

In the above-described manner, the substrate (object to be molded) 1 is resin-molded using the lower die cavity 203 (resin molding step). The method of solidifying the flowable resin 20 b is not limited to particular methods. For example, in the case where the flowable resin 20b is a thermosetting resin, the flowable resin 20b may be continuously heated and cured (solidified). For example, in the case where the flowable resin 20b is a thermoplastic resin, the heating of the flowable resin 20b may be stopped,

and the flowable resin 20b may be allowed to stand for a while to solidify.

[0052] Thereafter, as shown in FIG. 12, the lower die 200 and the upper die 100 are unclamped by lowering the entire lower die 200 in a direction indicated by the arrow X2.

Accordingly, the resin molded body (resin molded product) 1b obtained by resin

5 molding one surface of the substrate 1 with a cured resin (encapsulation resin) 20 is taken out of the lower die 200. Thereafter, the resin molded product 1b is removed from the upper die 100 by releasing the suction in the direction indicated by the arrow V1 in the upper die 100. In the above-described manner, a resin molded product 1b can be produced. The resin molded product 1b is an electronic component obtained by resin
10 encapsulation of a chip 2 on the substrate 1.

[0053] FIGs. 8 to 12 show an example of producing a resin molded product 1b that is an electronic component by embedding a chip 2 in a substrate 1 and resin encapsulating (resin molding) the chip. The present invention, however, is by no means limited by the example. For example, a member embedded in the substrate 1 is not limited to the chip
15 2 and may be any member. That is, other members may be embedded (fixed) in the surface of the substrate 1 in addition to or instead of the chip 2. Members other than the chip 2 are not limited to particular members and can be, for example, wires. Further, for example, other members may not be embedded in the substrate (object to be molded), and the substrate 1 may be simply resin-molded into a resin molded product. The resin
20 molded product of the present invention is not limited to an electronic component and

may be any resin molded product.

[0054] In addition, although FIGs. 8 to 12 show a “pre-cut” method in which a resin is supplied onto a pre-cut release film and then conveyed to a molding die, the present invention is not limited thereto. For example, in the molding die, the resin molding apparatus, or a method for producing a resin molded product of the present invention, a “roll-to-roll” (reel-to-reel) method in which a release film is disposed (supplied) on a die cavity of the molding die and a resin is thereafter supplied on the die cavity via the release film may be applied. In the case of the pre-cut method, a release film absorption portion (release film holding portion) may be provided on the lower die side member as shown in FIGs. 8 to 12, for example. In the case of the roll-to-roll (reel-to-reel) method, another release film holding mechanism may be used in addition to or instead of the release film absorption portion (release film holding portion). The release film holding mechanism in the roll-to-roll (reel-to-reel) method is not limited to particular mechanisms and may be, for example, similar to or equivalent to a commonly used release film holding mechanism.

The release film holding mechanism can be, for example, a type in which a release film is held by being sandwiched between an upper die and a lower die side member (e.g., described in JP 2017-183443 A) or a type in which a release film is held by being sandwiched between an intermediate die (intermediate plate) and the lower die side member (e.g., JP 2017-7272 A).

[0055] In the present embodiment, the resin molded product 1b produced by the resin

molding step is used as a resin molded product as it is. However, the present invention is not limited to this and may further include a step of further processing the resin molded product produced in the resin molding step into a resin molded product. For example, when the resin molded product contains unnecessary resin, fins, etc. because of the

5 molding by transfer molding etc., they may be removed from the resin molded product to produce a resin molded product.

[0056] The present embodiment shows an example of compression molding. However, as mentioned above, in the present invention, the resin molding method is not limited to particular methods, and for example, any molding method such as compression molding,

10 transfer molding injection molding, or the like may be used.

[0057] The present invention allows the molding object drop prevention block to support an object to be molded only at a part of the end thereof as shown in the present embodiment, for example. It is thus possible to perform resin molding (resin encapsulation) on, for example, all parts of a surface to be resin-molded (surface to be

15 resin encapsulated) of the object to be molded except the part supported by the object drop prevention block. It is possible to perform resin molding (resin encapsulation) on almost the whole surface of the surface to be resin-molded (surface to be resin encapsulated) of the object to be molded, so that it is possible to ensure a large area of the region to be resin-molded in the object to be molded. More specifically, for example, as

20 shown in the present embodiment, it is also possible to perform resin molding (resin

encapsulation) to the side of the object to be molded (e.g., a substrate).

[0058] The present invention can prevent the object to be molded from dropping even when the degree of vacuum in the lower die cavity approaches that in the molding object absorption portion while the object to be molded is adsorbed by the upper die in the
5 depressurizing step of depressurizing the inside of the lower die cavity, as mentioned above, for example.

[0059] Moreover, the present invention can perform resin molding in the state where a release film is disposed in a lower die as shown in the present embodiment, for example.

For example, a release film cannot be used in a configuration in which the inside of a
10 cavity is depressurized while a substrate is supported by a support pin, described in JP 2014-39065 A. In contrast, the present invention can perform resin molding using a release film. The present invention, however, is not limited to the example, and resin molding may be performed without using a release film, as mentioned above.

15 Second Embodiment

[0060] Another example of the present invention is described below.

[0061] In the present embodiment, another example of the molding die, the resin molding apparatus, and the method for producing a resin molded product, which is different from the first embodiment is described.

20 [0062] In the present embodiment, an area where a molding object drop prevention

block is in contact with an object to be molded is made smaller than that of the first embodiment to make the area of a region to be molded (region to be resin-molded) larger than that in the first embodiment.

[0063] FIG. 13 shows schematic views each showing the structure of a lower die 200 in

5 a molding die of the present embodiment (second embodiment). FIG. 13A is a plane view (top view), and FIG. 13B is a side view. FIG. 14 is a perspective view of the lower die 200 of FIG. 13. As shown in FIGs. 13 and 14, this lower die 200 is the same as the molding die 200 of the first embodiment except that it includes a molding object drop prevention block (substrate drop prevention block) 211b instead of the molding object

10 drop prevention block (substrate drop prevention block) 211. As shown in FIGs. 13 and 14, the molding object drop prevention block 211b is smaller than the molding object drop prevention block 211. Moreover, the structure of a portion to which the molding object drop prevention block 211b is attached is different from that for the molding object drop prevention block 211. Specifically, the present embodiment is described below

15 with reference to FIG. 15.

[0064] FIGs. 15A to 15C are schematic views showing the structure of a portion to which a molding object drop prevention block 211b is attached in the lower die 200 of FIGs. 13 and 14 and the motion of the lower die 200. FIGs. 15A and 15B are partial cross-sectional views, and FIG. 15C is a partial plane view.

20 [0065] FIG. 15A shows an unclamped state (the state where the molding object drop

prevention block 211b is being lifted). FIG. 15 B shows a clamped state (the state where the molding object drop prevention block 211b is being lowered). As in the first embodiment, a spring (elastic member) 217 is disposed in the spring storage hole (elastic member storage hole) 213 of the lower die side member (B) 201B. Moreover, the lower

5 portion of the molding object drop prevention block 211 is provided with a hole, and the upper portion of the spring 217 is placed in the hole. Accordingly, the spring 217 is disposed to be sandwiched between the molding object drop prevention block 211b and the lower die side member (B) 201B. In the present embodiment, there is no bolt fixing through hole 212, bolt 214, washer 215, and collar 216. As shown in FIGs. 15A and

10 15B, the molding object drop prevention block 211b is fixed on the lower die side member 201 by mere spring storage hole 213 and spring 217. As described above, in the present embodiment, the molding object drop prevention block 211b is L-shaped in side view to further simplify the structure of the portion to which the molding object drop prevention block is attached of the first embodiment. That is, as shown in FIGs. 15A

15 and 15B, the molding object drop prevention block 211b is L-shaped by protruding laterally. Further, as shown in FIG. 15A, the protruding portion of the molding object drop prevention block 211b is engaged in the lower die side member (A) 201A in the state where the molding object drop prevention block 211b is being lifted, whereby the molding object drop prevention block 211b does not come free from the lower die side

20 member 201.

[0066] FIG. 15C is a partial plane view (top view) showing the state of the lower die 200 of the molding die of the present embodiment after resin molding. In FIG. 15C, illustration of an upper die 100 and a substrate 1 is omitted to simplify the drawing. As shown in FIG. 15C, a portion where the molding object drop prevention block 211b is in contact with the substrate 1 at the peripheral edge of a region to be resin-molded (encapsulated) with a cured resin (encapsulation resin) 20 is not resin-molded. However, in the present embodiment, the size of the molding object drop prevention block 211b is smaller than that of the molding object drop prevention block 211 of the first embodiment, whereby the area not to be resin-molded is smaller. Furthermore, as mentioned below, as a modification of the present embodiment, the molding object drop prevention block can be provided with a notch portion (engraved portion) to eliminate the region not to be resin-molded.

[0067] FIG. 16 shows configurations of the molding object drop prevention block and the periphery thereof in the lower die 200 of the molding die of the present embodiment.

FIG. 16A shows an unclamped state, and FIG. 16B shows a clamped state. FIG. 16 shows, as a modification, an example where a molding object drop prevention block is provided with a notch portion (engraved portion). As shown in FIG. 16, this lower die 200 includes a molding object drop prevention block 211c instead of the molding object drop prevention block 211b. The molding object drop prevention block 211c is the same as the molding object drop prevention block 211b except that it is provided with a

notch portion (engraved portion) α in a portion facing the lower die cavity 203. As shown in FIG. 16A, the molding object drop prevention block 211 in the unclamped state is lifted and protrudes from the upper surface of the lower die side member (A) 201A.

Thus, as in the first embodiment, the molding object drop prevention block 211c can

5 support an object to be molded to prevent the object from dropping. On the other hand,

as shown in FIG. 16B, the molding object drop prevention block 211c in the clamped state is lowered and does not protrude from the upper surface of the lower die side

member (A) 201A. Thus, the upper surfaces of the lower die side member (A) 201A and the molding object drop prevention block 211 are flush with each other. In an

10 example shown in FIG. 16, the molding object drop prevention block 211c is provided with a notch portion (engraved portion) α as mentioned above. Accordingly, as shown in FIG. 16C, the molding object drop prevention block 211c in the clamped state does not protrude from the upper surface of the lower die side member (A) 201A. Thus, a portion not to be resin-molded (resin encapsulated) in the peripheral edge of the region to be

15 resin-molded can be eliminated. When the molding die 200 includes a molding object drop prevention block 211b instead of the molding object drop prevention block 211c, the configuration of the molding object drop prevention block 211b is the same as that of FIG. 16 except that it does not include a notch portion (engraved portion) α .

[0068] FIGs. 17 and 18 are cross-sectional views schematically showing the clamped

20 state in the molding die 1000 of the present embodiment. More specifically, FIGs. 17

and 18 each shows the state where the molding die 1000 is clamped, and the lower surface of the substrate 1 is resin-molded with a cured resin (encapsulation resin) 20.

FIG. 17 shows an example where the molding object drop prevention block does not have a notch portion (engraved portion). FIG. 18 shows an example where the molding

5 object drop prevention block has a notch portion (engraved portion). In FIGs. 17 and 18, illustration of a release film 40 and a chip 2 is omitted to simplify the drawings. As in FIGs. 7 to 12 (first embodiment), FIGs. 17 and 18 show the configurations of the upper die 100 and the lower die 200 in a simplified manner, as appropriate.

[0069] The molding die 1000 of FIG. 17 is the same as that of the first embodiment
10 (FIGs. 7 to 12) except that it includes a molding object drop prevention block 211b instead of the molding object drop prevention block 211. The molding die 1000 of FIG. 18 is the same as that of the first embodiment (FIGs. 7 to 12) except that it includes a molding object drop prevention block 211c instead of the molding object drop prevention block 211. As mentioned above, the molding object drop prevention block 211b does
15 not have a notch portion (engraved portion) α , and the molding object drop prevention block 211c has a notch portion (engraved portion) α .

[0070] As shown in FIG. 17, in the case of the molding object drop prevention block 211b having no notch portion (engraved portion) α , a portion β not to be resin-molded (resin encapsulated) is formed in a portion in contact with the molding object drop
20 prevention block 211b and in the vicinity thereof on the outer periphery of the substrate 1.

On the other hand, as shown in FIG. 18, in the case of the engraved portion 211c having a notch portion (engraved portion) α , a resin cannot enter a gap between the notch portion (engraved portion) and the substrate 1, whereby a portion not to be resin-molded (resin encapsulated) is not formed on the outer periphery of the substrate 1.

5 [0071] A large gap between the notch portion (engraved portion) α and the substrate 1 may lead the substrate 1 to drop from the gap. However, in the case where the gap between the notch portion (engraved portion) α and the substrate 1 is small enough to cause no problem where the substrate 1 is dropped from the gap, an aspect of the molding object drop prevention block 211c having a notch portion (engraved portion) α can be
10 employed as shown in FIG. 18.

[0072] On the other hand, if a gap is not formed between the substrate 1 and the molding object drop prevention block 211b having no notch portion (engraved portion) as shown in FIG. 17, there is no possibility where the substrate 1 is dropped. In addition, the present invention can make a portion β not to be resin-molded (resin encapsulated) on
15 the outer periphery of the substrate 1 to be extremely small. FIG. 19 is a plane view showing the example thereof. FIG. 19 is a plane view schematically showing the structure of a resin molded product 1 formed by resin molding in a molding die 1000 of FIG. 17. As shown in FIG. 19, there are four portions β not to be resin-molded (resin encapsulated) in a portion in contact with the molding object drop prevention block 211b
20 and in the vicinity thereof on the outer periphery of the substrate 1. However, as shown

in FIG. 19, the portions β not to be resin-molded (resin encapsulated) are extremely small.

Third Embodiment

[0073] Yet another example of the present invention is described below.

5 [0074] In the present embodiment, another example of the molding die, the resin molding apparatus, and the method for producing a resin molded product, which is different from the first and second embodiments is described.

[0075] The first and second embodiments mainly show the configuration of a molding die, but the present embodiment shows an example of the configuration of the entire resin
10 molding apparatus. However, the configuration of the resin molding apparatus of the present invention is not limited to this and may be any configuration. The molding die is not limited to particular dies and may be, for example, the same as those of the first and second embodiments.

[0076] FIG. 20 is a plan view schematically showing the configuration of the resin
15 molding apparatus of the present embodiment. The resin molding apparatus of FIG. 20 is an apparatus for producing a resin molded product (e.g., electronic component). As shown in FIG. 20, a release film cutting module (release film cutting mechanism) 510, a resin supply mechanism (resin supply module) 520, a compression molding mechanism (compression molding module) 530, a conveying mechanism (conveying module) 540,
20 and a control unit 550 are disposed in this order from the right side of FIG. 20.

Although the modules are separated from each other, they can be attached to and detached from adjacent modules. The resin supply module 520 supplies a resin material for resin molding on a release film as mentioned below.

[0077] The release film cutting module (release film cutting mechanism) 510 can cut a long release film into a circular release film and separate the circular release film from the long release film. As shown in FIG. 20, the release film cutting module 510 includes a film fixing table placement mechanism 511, a release film roll 512, and a film gripper 513.

A table (not shown) is placed on the upper surface of the film fixing table placement mechanism 511. The table is a fixing table for fixing a release film 40, so that it can also

be referred to as a “film fixing table”. As shown in FIG. 20, the release film roll 512 is unrolled by pulling the end of the release film to cover the upper surface of the table

placed on the film fixing table placement mechanism 511, whereby the release film can

be fixed on the table. The film gripper 513 can fix the end of the release film pulled

from the release film roll 512 on the side opposite to the release film roll 512 as viewed

from the film fixing table placement mechanism 511 while the release film roll 512 is

unrolled by pulling the release film. The release film can be cut into a circular release

film 40 by a cutter (not shown) on the film fixing table placement mechanism 511. The

release film cutting module 510 includes a discarded material disposal mechanism (not

shown) for disposing a remaining release film (discarded material) separated by cutting

the release film into a circular release film 40.

[0078] The resin supply module 520 includes a resin discharging mechanism, a resin loader (resin conveying mechanism) 521, and a post-processing mechanism 522. The resin discharging mechanism includes a dispenser 13 with a nozzle attached hereto. The table is not shown in FIG. 20 because FIG. 20 is a plane view (drawing as viewed from above) and the table is hidden from view by the release film 40. Further, the nozzle is not shown in FIG. 20 because it is hidden from view by the dispenser 13 in FIG. 20.

The resin supply module 520 may further include a camera (sensor), a heater, and the like as mentioned below. The resin loader 521 and the post-processing mechanism 522 are integrally formed. The release film 40 can be attached in the state where the resin material 20a (not shown in FIG. 20) is supplied on the release film 40 (to resin storage portion) adsorbed and fixed to the upper surface of the lower die, using the resin loader 521. Thus, the resin material 20a can be supplied and set in the state of being placed on the release film 40 in the lower die for compression molding described below in the compression molding module 530.

[0079] The compression molding module 530 includes a molding die 531 as shown in FIG. 20. The molding die 531 is not limited to particular dies and is, for example, a metallic mold. The molding die 531 includes an upper die and a lower die (not shown) as main components, and the lower die cavity 532 has a circular shape as shown in FIG. 20. The molding die 531 is further provided with an upper die substrate set portion (not shown) and lower die cavity bottom member (not shown) for pressurizing a resin. By

using a compression molding module 530, a chip (e.g., a semiconductor chip) embedded in a substrate before resin encapsulation (substrate before molding) can be resin encapsulated in an encapsulation resin (resin package) in a lower die cavity to form a resin encapsulated substrate (molded substrate). The compression molding module 530 may include, for example, a compression molding mechanism, and the molding die 531 may be, for example, the same as the molding die 1000 of the first or second embodiment as mentioned above. A resin molding method (method for producing a resin molded product) using the compression molding module 530 is also not limited to particular methods and may be, for example, the same as that of the first or second embodiment.

[0080] The conveying mechanism (conveying module) 540 can convey the chip (object to be resin encapsulated) before resin encapsulation together with a substrate and can convey an electronic component (resin molded product) after resin encapsulation. As shown in FIG. 20, the conveying mechanism (conveying module) 540 includes a substrate loader 541, a rail 542, and a robot arm 543. The rail 542 passes through a conveying mechanism (conveying module) 540 and extends to regions of the compression molding module 530 and the resin supply module 520. The substrate 544 can be placed on the substrate loader 541. The substrate 544 may be a substrate before resin encapsulation (substrate before molding) 544a or a resin encapsulated substrate (molded substrate) 544b. The substrate loader 541 and the resin loader 521 (post-processing mechanism 522) can move among the resin supply module 520, the

compression molding module 530, and the conveying module 540 on the rail 542. As shown in FIG. 20, the conveying module 540 includes substrate storage portions where a substrate before resin encapsulation (substrate before molding) 544a and the resin encapsulated substrate (molded substrate) 544b can be stored respectively. A chip (not shown in FIG. 20, e.g., a semiconductor chip) is embedded in the substrate before molding 544a. The chip is encapsulated in the molded substrate 544b by a resin (encapsulation resin) that is obtained by solidifying a flowable resin, to form an electronic component (resin molded product). The robot arm 543 can be used as follows, for example. That is, firstly, the substrate 544a before molding taken out from the storage portion for the substrate before molding 544a can be placed on the substrate loader 541 to face the chip-embedded surface downward by reversing front and back sides of the substrate 544a before molding. Secondly, the molded substrate 544b can be stored in a storage portion for the molded substrate to face the encapsulation resin side upward by taking the molded substrate 544b out of the substrate loader 541 and reversing front and back sides of the molded substrate 544b.

[0081] The control unit 550 controls cutting of a release film, discharging of the flowable resin, expansion of the flowable resin, conveyance of the substrate before molding and the molded substrate, conveyance of the resin material, conveyance of the release film, heating of the molding die, clamping and unclamping of the molding die.

In other words, the control unit 550 controls operations of the release film cutting module

510, the resin supply module 520, the molding module 530, and the conveying module 540 by controlling the components using the control unit in this manner, the resin molding apparatus of the present invention may function as a full automatic apparatus.

Alternatively, the resin molding apparatus of the present invention may function as a

5 hand-operated apparatus without the control unit. However, controlling the components using the control unit is efficient.

[0082] The position at which the control unit 550 is disposed is not limited to the position shown in FIG. 20 and may be any position. For example, the control unit can be disposed in at least one of the modules 510, 520, 530, and 540 or outside of the

10 modules. The control unit 550 may be configured as a plurality of control units each at least having a part separated according to the operation to be controlled.

[0083] In the resin molding apparatus of FIG. 20, the conveying module 540 that supplies the substrates and the resin supply module 520 that supplies the resin material on the release film are disposed to face each other by sandwiching the compression molding

15 module 530. The release film cutting module 510 that forms a circular release film is further disposed outside of the resin supply module 520. This resin molding apparatus is a separation-type resin molding apparatus including the modules separately disposed therein. The arrangement of the modules in the resin molding apparatus of the present invention is not limited to particular arrangements and may be other than the arrangement

20 shown in FIG. 20. For example, the configuration in which the required number of

compression molding modules are detachably disposed can be employed. Further, the release film cutting module (circular release film forming module), the resin supply module, and the conveying module (substrate module) can be disposed on one side of the compression molding module. In this case, the release film cutting module, the resin supply module, and the substrate module become a parent module, and the compression molding module becomes a child module (parent-child type). In this case, the required number of compression molding modules can be disposed side by side. The release film cutting module, the resin supply module, and the conveying module (substrate module) may be integrated. The release film cutting module, the resin supply module, and the conveying module (substrate module) may be integrated into one molding module, and the entire integrated component functions solely as a resin molding apparatus (e.g., compression molding apparatus).

[0084] When a plurality of compression molding modules are disposed between the conveying module (substrate module) and the resin supply module, and when a plurality of compression molding modules are disposed in order with respect to the parent module, the following arrangement is preferable. That is, it is preferable to dispose the molding modules side by side along the direction in which the rail used when components including the substrate loader, the resin loader, and the post-processing mechanism are moved extends. Further, each module of the resin molding apparatus of the present invention can be detachably attached to each other using a connection mechanism such as

a bolt and a nut or an appropriate positioning mechanism. Other compression molding module can be detachably attached to the compression molding module. In this case, the number of compression molding modules can be increased or decreased afterward.

[0085] The invention may be embodied in other forms without departing from the spirit or essential characteristics thereof. The embodiments disclosed in this application are to be considered in all respects as illustrative and not limiting. The scope of the invention is indicated by the appended claims rather than by the foregoing description, and all changes that come within the meaning and range of equivalency of the claims are intended to be embraced therein.

10

Explanation of reference numerals

[0086]

- | | |
|-------|---------------------------------|
| 1 | substrate (object to be molded) |
| 1b | resin molded product |
| 15 2 | chip |
| 13 | dispenser |
| 20 | cured resin |
| 20a | granular resin (resin material) |
| 20b | molten resin (flowable resin) |
| 20 40 | release film |

	100	upper die
	101	upper die side member (upper die outer circumferential member)
	102	upper die upper member (upper die cavity member)
	103	projection (clamp margin)
5	104	depression (bearing pressure clearance portion)
	105	step
	106	adsorption hole
	200	lower die
	201	lower die side member
10	201A	lower die side member (A)
	201B	lower die side member (B)
	202	lower die bottom member
	203	lower die cavity
	205	release film adsorption groove (release film holding portion)
15	211, 211b, 211c	molding object drop prevention block
	212	bolt fixing through hole
	213	spring storage hole
	214	bolt
	215	washer
20	216	collar

	217	spring (elastic member)
	510	release film cutting module (release film cutting mechanism)
	511	film fixing table placement mechanism
	512	release film roll
5	513	film gripper
	520	resin supply module (resin supply mechanism)
	521	resin loader
	522	post-processing mechanism
	523	film fixing table moving mechanism
10	530	compression molding mechanism (compression molding module)
	531	molding die
	532	lower die cavity
	540	conveying mechanism (conveying module)
	541	substrate loader
15	542	rail
	543	robot arm
	544a	substrate before resin encapsulation (substrate before molding)
	544b	resin encapsulated substrate (molded substrate)
	550	control unit
20	1000	molding die

V1, V2 arrow indicating suction direction

α notch portion (engraved portion)

β portion not to be resin-molded (resin encapsulated)

WHAT IS CLAIMED IS:

1. A molding die comprising:

an upper die; and

a lower die, wherein

5 the upper die is capable of adsorbing an object to be molded,

the lower die includes a lower die bottom member, a lower die side member, and
molding object drop prevention block,

a lower die cavity is formed by a space surrounded by the lower die bottom
member and the lower die side member, and

10 the molding object drop prevention block is provided on a part of an end portion
of the lower die side member facing the lower die cavity and is movable up and down.

2. The molding die according to claim 1, wherein the molding object drop
prevention block is attached to the lower die side member with an elastic member.

15

3. The molding die according to claim 1 or 2, wherein the lower die side member
includes a release film holding portion capable of holding a release film on the outer side
of the molding object drop prevention block.

20 4. A resin molding apparatus comprising the molding die according to any one of

claims 1 to 3.

5. A method for producing a resin molded product, comprising:

depressurizing, using the molding die according to any one of claims 1 to 3 or

5 the resin molding apparatus according to claim 4, the inside of the lower die cavity in a state where an object to be molded is adsorbed to the upper die and the molding object drop prevention block is in contact with at least one of the upper die or the object to be molded;

clamping the upper die and the lower die; and

10 resin molding the object to be molded using the lower die cavity.

6. The method according to claim 5, wherein the depressurizing is performed in a state where the object to be molded is supported by the molding object drop prevention block and the upper die.

15

7. The method according to claim 5 or 6, further comprising causing the release film holding portion to hold a release film, wherein

the molding die is the molding die according to claim 3, and

the depressurizing is performed in a state where the release film holding portion

20 holds the release film.