

DESCRIPTION

METHOD FOR COMPRESSION-MOLDING ELECTRONIC PARTS, AND MOLD
SYSTEM

5

TECHNICAL FIELD

[0001]

The present invention relates to a method for compression-molding electronic parts, such as integrated circuits (ICs), and also to a mold system used for this method.

10

BACKGROUND ART

[0002]

Fig. 6 shows a conventional mold system for compression-molding electronic parts. In this system, a metal mold 81 for compression-molding electronic parts is used to perform the compression-molding (resin-molding) of a required number of electronic parts 83 mounted on a substrate 82, using a granular resin material (granular resin) 84. Specifically, this system operates as follows.

[0003]

The metal mold 81 for compression-molding electronic parts includes an upper die 85 and a lower die 86. At the beginning of the process, a mold release film 88 is put on the inner surface of the cavity 87 of the lower die 86. Then, the granular resin 84 is supplied into the lower-die cavity 87 covered with the mold release film 88, after which the resin is melted by heat. Next, the metal mold 81 (85 and 86) is tightly closed so as to immerse the required number of electronic parts 83 mounted on the substrate 82 in the molten resin held in the lower-die cavity 87. Thus, the compression-molding of the required number of electronic

parts 83 in a resin-molded body having a shape corresponding to that of the lower-die cavity 87 is completed. This technique is the so-called "one-side batch molding."

In this process, the resin in the lower-die cavity 87 can be pressed by a cavity-bottom member 93 for pressing the resin.

5 [0004]

In this system, the process of supplying the granular resin 84 into the lower-die cavity 87 is performed by a resin-material supply mechanism 89 (a lower shutter 90 and a supply unit 91).

That is to say, after the required amount of granular resin 84 is put into the
10 resin-material supply mechanism 89 (supply unit 91), the resin-material supply mechanism 89 is moved into the space between the upper and lower dies 85 and 86, and the lower shutter 90 of the resin-material supply mechanism 89 is slid open to let the granular resin 84 fall from the supply unit 91 into the lower-die cavity 87.

15 PRIOR-ART DOCUMENT

PATENT DOCUMENT

[0005]

Patent Document 1: Japanese Unexamined Patent Application Publication No.
2004-216558

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DISCLOSURE OF THE INVENTION

PROBLEM TO BE SOLVED BY THE INVENTION

[0006]

However, in the process of supplying the granular resin 84 into the die cavity 87,
25 when the shutter 90 of the resin-material supply mechanism 89 is opened to let the granular

resin 84 fall into the lower-die cavity 87, a portion of the resin may possibly remain in the resin-material supply mechanism 89 (supply unit 91), as indicated by numeral 92.

Thus, one problem of the aforementioned method of supplying the granular resin 84 into the die cavity 87 exists in that the granular resin 84 cannot be efficiently supplied into
5 the die cavity 87.

Furthermore, in the process of supplying the granular resin 84 into the die cavity 87, the presence of the remaining portion 92 of the resin in the resin-material supply mechanism 89 (supply unit 91) is likely to lead to an insufficient supply of the resin into the die cavity 87.

10 Thus, another problem of the aforementioned method of supplying the granular resin 84 into the die cavity 87 exists in that it is impossible to efficiently improve the reliability of the amount of resin supplied into the die cavity 87.

[0007]

The problem to be solved by the present invention is to provide a technique for
15 supplying resin into a die cavity in such a manner that the resin can be efficiently supplied into the die cavity and the reliability of the amount of the resin supplied into the die cavity can be efficiently improved.

MEANS FOR SOLVING THE PROBLEMS

20 [0008]

To solve the previously described technical problems, the present invention provides a method for compression-molding electronic parts including the steps of supplying a required amount of resin material into a die cavity covered with a mold release film and then immersing the electronic parts in a resin held in the aforementioned cavity so as to perform,
25 in the aforementioned cavity, the compression-molding of the electronic parts in a

resin-molded body having a shape corresponding to the shape of the cavity. The present method is characterized by the following processes: preparing a resin-supplying plate having a resin-receiving section by covering the bottom side of a resin-receiving plate having an opening section corresponding to the die cavity with a mold release film; supplying a
5 required amount of resin material into the resin-receiving section of the resin-supplying plate; preparing a resin-flat-loaded plate in which the resin material in the resin-receiving section is formed into a flat layer having a uniform thickness; placing the resin-flat-loaded plate on the die cavity so that the resin-receiving section is adjusted at the position of the die cavity with the mold release film in between; covering the surface of the cavity with the
10 mold release film; and supplying the resin material from the resin-receiving section into the die cavity in the process of covering the surface of the cavity with the mold release film.

[0009]

One mode of the method for compression-molding electronic parts aimed at solving the previously described technical problem is characterized in that the process of preparing a
15 resin-flat-loaded plate in which the resin material in the resin-receiving section is formed into a flat layer having a uniform thickness includes the process of moving the resin-supplying plate in the X-direction or Y-direction, while supplying the required amount of resin material into the resin-receiving section of the resin-supplying plate, so as to form the resin material in the resin-receiving section into a flat layer having a uniform thickness.

20 [0010]

Another mode of the method for compression-molding electronic parts according to the present invention aimed at solving the previously described technical problem is characterized in that the process of preparing the resin-flat-loaded plate in which the resin material in the resin-receiving section is formed into a flat layer having a uniform thickness
25 includes the process of oscillating the resin-supplying plate so as to form the resin material in

the resin-receiving section into a flat layer having a uniform thickness.

[0011]

Another mode of the method for compression-molding electronic parts according to the present invention aimed at solving the previously described technical problem is
5 characterized in that the resin material is a granular resin material or a powdered resin material.

[0012]

To solve the previously described technical problem, the present invention also provides a mold system for compression-molding electronic parts including: a metal mold
10 for compression-molding electronic parts, the metal mold having an upper die and a lower die facing the upper die; a cavity for compression-molding, the cavity being provided in the lower die; a substrate-setting section provided in the upper die; a mold release film for covering the inner surface of the cavity of the lower die; a cavity-bottom member for pressing the resin in the cavity of the lower die; and an inloader for supplying a resin
15 material and a substrate with electronic parts mounted thereon into the metal mold. The present mold system is characterized by including: a resin-receiving plate being attached to the inloader and having an opening section; a mold release film for covering the lower side of the resin-receiving plate to make the opening section function as a resin-receiving section; and a resin-material distribution means for supplying a resin material into the resin-receiving
20 section, wherein the mold release film covering the inner surface of the cavity for compression-molding and the mold release film covering the lower side of the resin-receiving plate are the same.

[0013]

One mode of the mold system for compression-molding electronic parts according to
25 the present invention aimed at solving the previously described technical problem is

characterized in that the resin-material distribution means for supplying a resin material into the resin-receiving section includes a resin-material supply means for supplying a resin material into the resin-receiving section, a resin-material measurement means for measuring the amount of the resin material to be supplied in the resin-receiving section, and a
5 resin-material flattening means for flattening the resin material supplied in the resin-receiving section.

[0014]

Another mode of the mold system for compression-molding electronic parts according to the present invention aimed at solving the previously described technical
10 problem is characterized in that the resin-material flattening means is a horizontally-moving flattening mechanism for moving the resin-receiving plate in the X-direction or Y-direction.

[0015]

Another mode of the mold system for compression-molding electronic parts according to the present invention aimed at solving the previously described technical
15 problem is characterized in that the resin material is a granular resin material or a powdered resin material.

EFFECTS OF THE INVENTION

[0016]

The present invention has the excellent effect that the resin can be efficiently
20 supplied into the die cavity in the process of supplying resin into the die cavity.

The present invention has another excellent effect that the reliability of the amount of resin supplied into the die cavity can be efficiently improved in the process of supplying resin into the die cavity.

BRIEF DESCRIPTION OF THE DRAWINGS

[0017]

Fig. 1 is a schematic perspective view of a resin-receiving plate and a resin-material distribution mechanism, which illustrates a method for compression-molding electronic parts according to the present invention; specifically, the figure shows the situation where a resin material is being distributed into the aforementioned plate.

Figs. 2(1) and 2(2) are perspective views of the resin-receiving plate, which illustrates the method for compression-molding electronic parts according to the present invention; specifically, Fig. 2(1) shows the situation where a resin material has been distributed in the plate in the resin-material distributing mechanism shown in Fig. 1, and Fig. 2(2) shows a resin-flat-loaded plate in which the resin material has been distributed by the resin-material distribution mechanism shown in Fig. 1.

Fig. 3 is a schematic vertical sectional view of a mold system for compression-molding electronic parts, which illustrates the method for compression-molding electronic parts according to the present invention; specifically, the figure shows the situation where the resin-flat-loaded plate shown in Fig. 2(2) has been set in the mold system.

Fig. 4 is a schematic vertical sectional view, corresponding to Fig. 3, of the mold system for compression-molding electronic parts; specifically, the figure shows the situation where a mold release film is suctioned and pulled onto the inner surface of a lower-die cavity in the mold system (metal mold) so as to make the resin material fall from the resin-flat-loaded plate into the cavity covered with the mold release film.

Fig. 5 is a schematic vertical sectional view, corresponding to Fig. 3, of the mold system (metal mold) for compression-molding electronic parts, showing the metal mold in the closed state.

Fig. 6 is a schematic vertical sectional view of a mold system for compression-molding electronic parts, which illustrates a conventional method for

compression-molding electronic parts.

BEST MODE FOR CARRYING OUT THE INVENTION

[0018]

5 According to the present invention, a mold release film is firstly suctioned and held on the bottom side of the resin-receiving plate to close the plate-bottom opening of the opening section so that the opening section of the resin-receiving plate can function as the resin-receiving section. Thus, a resin-receiving plate having a resin-receiving section is obtained.

10 Next, by means of the resin-material distribution means, a required amount of granular resin material (granular resin) is supplied from the plate-top opening into the resin-receiving section of the resin-supplying plate. Then, by means of the flattening means, the required amount of granular resin is formed into a flat layer having a uniform thickness. Thus, a resin-flat-loaded plate holding the required amount of flattened granular resin in the
15 resin-receiving section is prepared.

Subsequently, the resin-flat-loaded plate is attached to the lower side of the inloader, and a substrate having a required number of electronic parts mounted thereon is placed on the upper side of the inloader, with the mounted electronic parts directed downwards.

Then, the inloader is inserted into the space between the upper and lower dies in the
20 metal mold for compression-molding electronic parts.

In this process, the substrate with the electronic parts mounted thereon is supplied and set onto the substrate-setting section of the upper die, with the mounted electronic parts directed downwards.

[0019]

25 Next, the inloader is moved downwards, whereby the resin-flat-loaded plate is set

onto the mold face of the lower die.

This process is carried out so that the plate-bottom opening of the resin-flat-loaded plate is adjusted at the position of the opening section of the cavity with the mold release film in between.

5 At this point, the required amount of granular resin in the resin-receiving section of the resin-flat-loaded plate is in the form a flat layer on the mold release film.

Subsequently, the operation of suctioning and holding the mold release film on the resin-flat-loaded plate is discontinued.

Furthermore, the air is forcibly suctioned and removed from the mold face of the
10 lower die and the cavity, whereby the mold release film is held onto the mold face of the lower die and also pulled into the cavity so as to cover the cavity with the mold release film.

In this process, the required amount of flattened granular resin lying on the mold release film also falls into the lower-die cavity together with the mold release film (without being separated from the film), wherein the required amount of granular resin is maintained
15 in a flattened form. Thus, the required amount of flattened granular resin is pulled into the lower-die cavity.

Thus, the required amount of granular resin in a flattened form (with a uniform thickness) can be supplied into the lower-die cavity covered with the mold release film.

In this manner, a required amount of granular resin in a flattened form can be
20 supplied into the lower-die cavity covered with the mold release film, by making the required amount of flattened granular resin fall into the lower-die cavity together with the mold release film (without being separated from the film).

Thus, according to the present invention, in the process of supplying resin into a die cavity, the resin can be efficiently supplied into the die cavity.

25 Furthermore, in the process of supplying resin into a die cavity, a required amount of

granular resin in a flattened form can be supplied into the lower-die cavity covered with the mold release film, whereby the reliability of the amount of resin supplied into the die cavity can be efficiently improved.

This is also advantageous in that the granular resin in a flattened form (with a
5 uniform thickness) in the cavity covered with the mold release film can be evenly heated and melted.

Accordingly, it is possible to efficiently prevent the resin in the cavity from being partially hardened and forming an unmixed lump.

10 EMBODIMENT

[0020]

One embodiment (the present invention) is hereinafter described in detail.

(Configuration of Mold System with Metal Mold for Compression-Molding Electronic Parts)

Firstly, a mold system for compression-molding electronic parts having a metal mold
15 (mold assembly) 1 for compression-molding electronic parts used in the method of compression-molding electronic parts illustrated in the present embodiment is hereinafter described.

As shown in the illustrated example, the mold system for compression-molding electronic parts includes a metal mold (mold assembly) 1 for compression-molding
20 electronic parts, an inloader 9 by which a required amount of granular resin material (granular resin) 6 and a substrate 8 having a required number of electronic parts 7 mounted thereon ("ante-molding substrate") can be separately or simultaneously supplied into the metal mold 1, an unloader (not shown) for removing a molded substrate (i.e. a resin-molded body 12, which will be described later) obtained by a compression-molding (resin-molding)
25 process using the metal mold 1, and a mold-closing mechanism (not shown) for closing the

metal mold 1.

By this configuration, a molded substrate (resin-molded body 12) can be created using the metal mold 1 by supplying a required amount of granular resin 6 and a substrate 8 into the metal mold 1 by the inloader 9, and the molded substrate can be removed from the metal mold 1 by the unloader.

[0021]

As will be described later, the mold system illustrated in the present embodiment includes a resin-material distribution means 31 for supplying and distributing a required amount of granular resin 6 into a resin-supplying plate 21a, which is to be attached to the inloader 9.

By this configuration, a required amount of granular resin 6 can be supplied into and distributed in a resin-supplying plate 21a by the resin-material distribution means 31 to prepare a resin-flat-loaded plate 25 (a required amount of flattened granular resin 6), which will be described later.

[0022]

(Configuration of Metal Mold for Compression-Molding Electronic Parts)

As shown in the illustrated example, the metal mold (mold assembly) 1 for compression-molding electronic parts includes a fixed upper die 2 and a movable lower die 3 facing the upper die 2.

The upper die 2 has, on its mold face, a substrate-setting section 4 onto which a substrate 8 with a required number of electronic parts 7 mounted thereon can be supplied and set, with the mounted electronic parts directed downwards.

The lower die 3 has, on its mold face, a cavity 5 for compression molding. This cavity has a cavity opening 10 facing upwards (i.e. toward the upper die 2).

By this configuration, the electronic parts 7 mounted on the substrate 8 supplied and

set on the substrate-setting section 4 of the upper die can be set into the lower-die cavity 5 by closing the upper and lower dies 1 (2 and 3).

[0023]

The upper and lower dies 1 (2 and 3) are provided with a heating means (not shown)
5 for heating the upper and lower dies 1 (2 and 3) to a required temperature.

Accordingly, the required amount of granular resin 6 supplied into the lower-die cavity 5 by the inloader 9 (the resin-flat-loaded plate 25, which will be described later) can be melted by heating it with the heating means of the metal mold 1.

At the bottom of the cavity 5, a cavity-bottom member 38 for pressing the resin 6 in
10 the cavity 5 by a required pressure is provided.

Accordingly, the electronic parts 7 mounted on the substrate 8 can be compression-molded (resin-molded) in the lower-die cavity 5 by pressing the resin 6 in the lower-die cavity 5 with the cavity-bottom member 38.

[0024]

15 (Film-Holding Mechanism in Lower Die)

Though not shown, a film-holding mechanism for suctioning and holding the mold release film 11 is provided on the mold face of the lower die and on the cavity 5 in the lower die 3.

For example, the suction mechanism may include a suction hole, a vacuum channel
20 and an evacuation mechanism (vacuum pump). The suction hole may be a hole bored through the lower die 3 to the mold face of the lower die 3 and to the surface of the cavity 5.

Accordingly, the mold release film 11 can be fitted onto and held on the mold face of the lower die 3 and the surface of the cavity 5 by energizing the suction mechanism to forcibly suction and remove air.

25 For example, after the mold release film 11 (in a flat form) is placed on the mold face

of the lower-die 3, when the suction mechanism is energized, the mold release film 11 is initially held onto the mold face of the lower-die 3, after which the mold release film 11 is pulled into the lower-die cavity 5. Thus, the mold release film 11 can be fitted onto and held on the surface of the lower-die cavity 5.

5 [0025]

As will be described later, according to the present invention, when the mold release film 11 is pulled into and fitted onto the lower-die cavity 5, the required amount of granular resin 6 (in a flattened form, as will be described later) lying on the mold release film 11 in the resin-flat-loaded plate 25 (which will be described later) is also made to fall into the
10 lower-die cavity 5 together with the mold release film 11 being pulled. In this manner, the required amount of granular resin 6 (in a flattened form, as will be described later) can be supplied into the cavity 5 covered with the mold release film 11.

After the required amount of granular resin 6 is supplied into the cavity 5 covered with the mold release film 11, the upper and lower dies 1 (2 and 3) are closed, whereby the
15 electronic parts 7 mounted on the substrate 8 supplied and set on the substrate-setting section 4 of the upper die is immersed in the molten resin 6 held in the cavity 5 covered with the mold release film 11. Subsequently, the resin (6) in the cavity 5 is pressed by the cavity-bottom member 38 via the mold release film 11. Thus, in the lower-die cavity 5, the electronic parts 7 mounted on the substrate 8 are compression-molded (resin-molded) in the
20 resin-molded body 12 having a shape corresponding to that of the lower-die cavity 5.

[0026]

(Configuration of Resin-Receiving Plate)

The configuration of the resin-receiving plate 21 (resin-supplying plate 21a) for supplying a required amount of granular resin 6 into the lower-die cavity 5 according to the
25 present invention is hereinafter described.

The resin-receiving plate 21 has a vertically-penetrating opening section 37 and a plate periphery section 24 (outer frame) surrounding the opening section 37.

The opening section 37 has a plate-top opening 39 provided on the top side of the plate and a plate-bottom opening 23 provided on the bottom side of the same plate.

5 Though not shown, a film-holding mechanism for suctioning and holding the mold release film 11 is provided on the bottom side of the plate periphery section 24.

By this film-holding mechanism, the mold release film 11 can be suctioned and held on the bottom side of the plate periphery section 24 so as to close the plate-bottom opening 23 (opening section 37) by the mold release film 11.

10 Thus, a resin-receiving section 22 having a hollow interior for receiving a required amount of granular resin 6 can be formed by closing the plate-bottom opening 23 of the opening section 37 by the mold release film 11.

As a result of forming the resin-receiving section 22 with the mold release film 11, a resin-supplying plate 21a is obtained. That is to say, the resin-supplying plate 21a having the
15 resin-receiving section 22 consists of the resin-receiving plate 21 and the mold release film 11.

Accordingly, as will be described later, a required amount of granular resin 6 can be supplied through the plate-top opening 39 into the resin-receiving section 22 of the resin-supplying plate 21a by the resin-material distribution means 31.

20 The plate-top and plate-bottom openings 23 and 39 are designed so that their (horizontal) shape matches the (horizontal) shape of the cavity opening 10.

For example, it is possible to give a rectangular shape to the cavity opening 10 and also design the plate-top and plate-bottom openings 23 and 39 so that their shape matches the rectangular shape of the cavity opening 10.

25 [0027]

(Configuration of Resin-Material Distribution Means)

In the present embodiment, in the resin-material distribution means 31 (means for measuring, supplying and flattening a resin material) shown in Fig. 1, a required amount of granular resin 6 is measured out and supplied into the resin-receiving section 22 of the resin-supplying plate 21a. Then, the granular resin 6 supplied in the resin-receiving section 22 of the resin-supplying plate 21a is formed into a flat layer having a uniform thickness (a constant amount of resin per unit area). Thus, a required amount of flattened granular resin 6 can be distributed in the resin-receiving section 22 of the resin-supplying plate 21a.

The resin-material distribution means 31 includes a loader-side resin-material distribution means 31a and a receiver-side resin-material distribution means 31b.

[0028]

(Loader-Side Resin-Material Distribution Means)

As shown in Fig. 1, the loader-side resin-material distribution means 31a includes a resin-material loading means (resin-material supply means) 32 for loading a required amount of granular resin 6 into the resin-receiving section 22 of the resin-supplying plate 21a, and a feeder-side measurement means (load cell) 33 for measuring out a required amount of granular resin 6 to be loaded into the resin-receiving section 22 of the resin-supplying plate 21a.

As shown in Fig. 1, the resin-material loading means 32 includes a hopper 34 for holding the granular resin and a linear oscillation feeder 35 for moving and supplying the granular resin 6 into the resin-receiving section 22 of the resin-supplying plate 21a while oscillating the granular resin 6 with an appropriate oscillation means (not shown).

In the process of supplying and loading the granular resin 6, the amount of granular resin 6 to be supplied into the resin-receiving section 22 of the resin-supplying plate 21a can be measured by the feeder-side measurement means (load cell) 33.

Accordingly, in the loader-side resin-material distribution means 31a, a required amount of granular resin 6 can be supplied (gradually, for example) into the resin-receiving section 22 of the resin-supplying plate 21a by moving the granular resin 6 supplied from the hopper 34 while oscillating the granular resin 6 with the linear oscillation feeder 35.

- 5 Additionally, for example, the linear oscillation feeder 35 may be configured so as to supply a constant amount of resin per unit time into the resin-receiving section 22 of the resin-supplying plate 21a by oscillating the granular resin 6.

[0029]

(Receiver-Side Resin-Material Distribution Means)

- 10 As shown in Fig. 1, the receiver-side resin-material distribution means 31b includes a resin-supplying plate preparation means (not shown) for preparing the resin-supplying plate 21a having the resin-receiving section 22 by suctioning and holding the mold release film 11 on the bottom side of the resin-receiving plate 21 by the film-holding mechanism of the resin-receiving plate 21, a plate-setting base 40 on which the resin-supplying plate 21a can
15 be placed, a plate transfer means (not shown) for transferring the resin-supplying plate 21a from the resin-supplying plate preparation means onto the plate-setting base 40, and a resin-material flattening means for flattening the required amount of granular resin 6 supplied from the linear oscillation feeder 35 of the loader-side resin-material distribution means 31a into the resin-receiving section 22 of the resin-supplying plate 21a placed on the
20 plate-setting base 40, to form a flat layer of the granular resin having a required thickness (e.g. the horizontally-moving flattening mechanism 42 for the resin material, which will be described later).

- Accordingly, in the receiver-side resin-material distribution means 31b, the resin-supplying plate 21a having the resin-receiving section 22 is initially prepared by the
25 resin-supplying plate preparation means. Next, the resin-supplying plate 21a is transferred

onto the plate-setting base 40 by the plate transfer means. Subsequently, the required amount of granular resin 6 can be moved and supplied from the linear oscillation feeder 35 into the resin-receiving section 22 of the resin-supplying plate 21a while being oscillated by the linear oscillation feeder 35.

5 As a result of the coordinated operations of the resin-material flattening means (the horizontally-moving flattening mechanism 42) and the linear oscillation feeder 35, the required amount of granular resin 6 supplied in the resin-receiving section 22 can be formed into a flat layer having a uniform thickness (41).

[0030]

10 (Resin-Material Flattening Means)

In the receiver-side resin-material distribution means 31b, a horizontally-moving flattening mechanism 42 is provided as an example of the resin-material flattening means.

The horizontally-moving flattening mechanism 42 is configured so that the resin-supplying plate 21a placed on the plate-setting base 40 can be moved in a horizontal
15 direction, i.e. in the X-direction or Y-direction in Fig. 1 respectively or in both directions simultaneously.

Accordingly, a required amount of granular resin 6 can be moved and supplied from the linear oscillation feeder 35 into the resin-receiving section 22 of the resin-supplying plate 21a on the plate-setting base 40 while being oscillated by the linear oscillation feeder 35.

20 During this process, the resin-supplying plate 21a can be moved in the X-direction or Y-direction by the horizontally-moving flattening mechanism 42 so that the required amount of granular resin 6 in the resin-receiving section 22 can be formed into a flat layer having a required uniform thickness 41 (refer to Fig. 3), i.e. a layer with a constant amount of resin per unit area. Thus, a resin-flat-loaded plate 25 can be prepared.

25 [0031]

(Configuration of Inloader)

The inloader 9 has, on the lower side thereof, a plate-attaching section 9a to which the resin-flat-loaded plate 25 (i.e. the resin-receiving plate 21 in which the required amount of flattened granular resin 6 is held in the resin-receiving section 22 formed by the mold
5 release film 11) can be attached.

The inloader 9 also has, on the upper side thereof, a substrate-placing section 9b on which the substrate 8 can be set, with the electronic parts 7 directed downwards.

Accordingly, by inserting the inloader 9 into the space between the upper and lower dies 1 (2 and 3) and moving the substrate 8 upwards, the substrate 8 with the electronic parts
10 7 mounted thereon can be supplied and set onto the substrate-setting section 4 of the upper die 2, with the mounted electronic parts directed downwards.

Furthermore, by inserting the inloader 9 into the space between the upper and lower dies 1 (2 and 3) and moving the inloader 9 downwards, the plate-bottom opening 23 of the resin-receiving plate 21 can be adjusted at the position of the cavity opening 10 of the lower
15 die 3, with the mold release film 11 in between.

In this process, the mold release film 11 becomes held between the mold face of the lower die 3 and the bottom side of the resin-receiving plate 21.

After that, the operation of suctioning and holding the mold release film by the film-holding mechanism provided on the lower side of the resin-receiving plate 21 can be
20 discontinued.

Furthermore, by means of the suction mechanism provided on the mold face of the lower die 3 and the surface of the cavity 5, the mold release film 11 can be held on the mold face of the lower die 3 and also pulled into the lower-die cavity 5 so as to cover the surface of the cavity 5 with the mold release film 11.

25 In this process, the required amount of flattened granular resin 6 lying on the mold

release film 11 in the resin-receiving section 22 (opening section 37) of the resin-flat-loaded plate 25 falls into the cavity 5 together with the mold release film 11 pulled into the cavity 5.

In this manner, the required amount of flattened resin material 6 can be (collectively) supplied into the cavity 5 covered with the mold release film 11.

5 Thus, the required amount of granular resin 6 can be formed into a layer of having a uniform thickness in the cavity 5 covered with the mold release film 11.

[0032]

(Mold Release Film)

The mold release film 11 used in the present invention (a short strip of mold release
10 film) is prepared by previously cutting ("pre-cutting") a long strip of mold release film (a roll of mold release film) into pieces of a required length.

Therefore, it is possible to omit the means for loading a roll of mold release film in the mold system. Such a means is required in the case of a mold system in which a roll of mold release film (a long strip of mold release film) loaded in the mold system is cut into a
15 mold release film 11 (a short strip of mold release film) every time the granular resin 6 is supplied into the resin-supplying plate 21a.

Accordingly, the entire size of the mold system according to the present invention can be smaller than that of the mold system in which a roll of mold release film must be loaded.

20 [0033]

(Method for Compression-Molding Electronic Parts)

Firstly, a mold release film 11 is suctioned and held onto the bottom side of the resin-receiving plate 21 to close the plate-bottom opening 23 of the opening section 37 and thereby form a resin-receiving section 22. Thus, a resin-supplying plate 21a having a
25 resin-receiving section 22 is prepared (refer to Figs. 2(1), 2(2) and 3).

Next, as shown in Fig. 1, the resin-supplying plate 21a is placed on the plate-setting base 40 in the resin-material distribution means 31.

In this process, the mold release film 11 becomes held between the resin-receiving plate 21 and the plate-setting base 40.

5 [0034]

Subsequently, in the resin-material distribution means 31, a required amount of granular resin 6 is measured out with the feeder-side measurement means (load cell) 33 in the loader-side resin-material distribution means 31a. Then, the required amount of granular resin 6 is moved and supplied from the hopper 34 through the plate-top opening 39 into the
10 resin-receiving section 22 of the resin-supplying plate 21a while being oscillated by the linear oscillation feeder 35.

Meanwhile, in the receiver-side resin-material distribution means 31b, the resin-supplying plate 21a placed on the plate-setting base 40 is moved in the X-direction or Y-direction respectively, or in both directions simultaneously, by the horizontally-moving
15 flattening mechanism 42 (resin-material flattening means), whereby the required amount of granular resin 6, while being oscillated and supplied into the resin-receiving section 22 of the resin-supplying plate 21a, is formed into a flat layer in the resin-receiving section 22 of the resin-supplying plate 21a. In this manner, a layer of the granular resin 6 having a uniform thickness can be formed (refer to Figs. 2(1), 2(2) and 3).

20 Accordingly, in the resin-material distribution means 31, a resin-flat-loaded plate 25 can be prepared by supplying a required amount of granular resin 6 into the resin-receiving section 22 of the resin-supplying plate 21a placed on the plate-setting base 40 while oscillating the granular resin 6 to flatten it.

This resin-flat-loaded plate 25 can be prepared while maintaining the required
25 amount of flattened granular resin 6 (i.e. while maintaining the required amount of granular

resin 6 in a flattened form with a uniform thickness) on the mold release film 11 held on the plate-bottom opening 23 of the opening section 37 (i.e. on the mold release film 11 in the resin-receiving section 22).

[0035]

5 Next, as shown in Fig. 3, the resin-flat-loaded plate 25 is attached to the plate-attaching section 9a of the inloader 9, while a substrate 8 with electronic parts 7 mounted thereon is placed on the substrate-placing section 9b of the inloader 9.

Subsequently, the inloader 9 is inserted into the space between the upper and lower dies 1 (2 and 3) and the substrate 8 is moved upwards, whereby the substrate 8 with the
10 electronic parts 7 mounted thereon is supplied and set onto the substrate-setting section 4 of the upper die 2, with the mounted electronic parts directed downwards.

After that, the inloader 9 is moved downwards to set the resin-flat-loaded plate 25 on the mold face of the lower die 3.

In this process, the plate-bottom opening 23 of the resin-flat-loaded plate 25 can be
15 adjusted at the opening 10 of the cavity 5, with the mold release film 11 in between.

At this stage, the required amount of granular resin 6 in a flattened form lies on the mold release film 11 in the resin-receiving section 22 of the resin-flat-loaded plate 25.

[0036]

Next, the operation of suctioning and holding the mold release film 11 by the
20 film-holding mechanism of the resin-flat-loaded plate 25 is discontinued.

Subsequently, as shown in Fig. 4, the suction mechanism provided in the lower die 3 is energized to forcibly suction and remove air through the mold face of the lower die 3 and the surface of the lower-die cavity 3.

In this process, the mold release film 11 is pulled into and fitted onto the cavity 5
25 while being held on the mold face of the lower die 3. Thus, the cavity 5 becomes covered

with the mold-release film 11.

Furthermore, in this process, as shown in Fig. 4, the required amount of flattened granular resin 6 lying on the mold release film 11 in the resin-receiving section 22 of the resin-flat-loaded plate 25 is made to fall into the lower-die cavity 5 together with the mold
5 release film 11 being pulled into the cavity 5.

Furthermore, in this process, the required amount of granular resin 6 in a flattened form, i.e. the granular resin 6 in a flattened form with a uniform thickness, can be supplied into the lower-die cavity 5 covered with the mold release film 11.

Accordingly, in the present case, the required amount of resin material 6 in a
10 flattened form (with a uniform thickness) lying on the mold release film 11 can be (collectively) made to fall and supplied into the cavity 5 covered with the mold release film 11 together with the mold release film 11 (without being separated from the film).

[0037]

As described thus far, according to the present invention, the inloader 9
15 (resin-material supply mechanism) with the resin-flat-loaded plate 25 attached thereto is positioned so that the plate-bottom opening 23 of the resin-flat-loaded plate 25 is located above the lower die 3 (cavity opening 10). By this method, a required amount of flattened granular resin 6 can be efficiently supplied into the lower-die cavity 5 covered with the mold release film 11.

20 Furthermore, according to the present invention, the required amount of granular resin in a flattened form (with a uniform thickness) is supplied into the lower-die cavity 5 covered with the mold release film 11. Therefore, it is possible to efficiently prevent the previously described conventional problem that a portion 92 of the resin is caught by the shutter 90 and remains in the supply mechanism 89.

25 Thus, the mold system according to the present invention requires no shutter 90

shown in the conventional example and hence is free from the conventional problem that a portion 92 of the granular resin 84 remains in the supply mechanism 89.

Therefore, according to the present invention, a required amount of flattened granular resin 6 (collectively and together with the mold release film 11) can be supplied into the
5 cavity 5 covered with the mold release film 11.

[0038]

After that, the required amount of granular resin 6 in a flattened form lying in the cavity 5 covered with the mold release film 11 is melted by heat.

In this process, the required amount of granular resin 6 supplied in the lower-die
10 cavity 5 covered with the mold release film 11 is in a flattened form (with a uniform thickness) and hence can be uniformly heated (e.g. from the bottom side of the cavity) and melted.

Accordingly, the formation of an unmixed-in lump (e.g. a small mass of hardened resin) can be more efficiently prevented than in the case where the granular resin 6 is
15 unevenly supplied in the lower-die cavity 5, in which case the granular resin 6 may possibly be partially hardened as a result of uneven heating and melting.

[0039]

Next, the lower die 3 is moved upwards to close the upper and lower dies 2 and 3, whereby the electronic parts 7 mounted on the substrate 8 supplied and set on the
20 substrate-setting section 4 of the upper die is immersed in the molten resin 6 held in the lower-die cavity 5. Simultaneously, the resin in the cavity 5 is pressed by means of the cavity-bottom member 38.

After the time required for hardening has elapsed, the upper and lower dies 2 and 3 are opened. Thus, the electronic parts 7 mounted on the substrate 8 in the cavity 5 can be
25 compression-molded (resin-molded) in a resin-molded body 12 corresponding to the shape

of the cavity 5.

[0040]

As described previously, according to the present method, a resin-flat-loaded plate 25 can be prepared by supplying and flattening a required amount of granular resin 6 into the resin-receiving section 22 of a resin-supplying plate 21a by means of the resin-material distribution means 31.

Furthermore, as described previously, a required amount of granular resin 6 in a flattened form (i.e. a required amount of granular resin 6 in the form of a layer with a uniform thickness) can be supplied into the cavity 5 covered with the mold release film 11, by making the required amount of flattened granular resin 6 on the mold release film 11 in the resin-receiving section 22 of the resin-flat-loaded plate 25 fall into the cavity 5 together with the mold release film 11 being pulled into the cavity 5.

Thus, according to the present invention, a required amount of granular resin 6 in a flattened form can be supplied into the cavity 5 covered with the mold release film 11, by making the required amount of flattened granular resin 6 fall into the cavity together with the mold release film 11 being pulled into the cavity 5. This method has the excellent effect that the resin can be efficiently supplied into the die cavity 5 in the process of supplying resin into the die cavity 5.

Furthermore, according to the present invention, as just described, a required amount of granular resin 6 in a flattened form can be supplied into the cavity 5 covered with the mold release film 11. This method has an additional excellent effect that the reliability of the amount of resin supplied into the die cavity 5 can be efficiently improved in the process of supplying resin into the die cavity 5.

[0041]

The present invention is not limited to the configurations described in the previous

embodiment. It is possible to arbitrarily and appropriately change and/or select those configurations as needed without departing from the spirit and scope of the present invention.

[0042]

5 (Another Means for Measuring Out Resin Material)

The receiver-side resin-material distribution means 31b is provided with a plate-side measurement means (load cell) 36 for measuring out a required amount of the granular resin 6 to be supplied and loaded into the resin-receiving section 22 of the resin-supplying plate 21a.

10 Accordingly, the amount of granular resin 6 to be supplied into the resin-receiving section 22 of the resin-supplying plate 21a may also be measured on the side of the receiver-side resin-material distribution means 31b by using the plate-side resin-material measurement means 36.

[0043]

15 To measure the amount of the granular resin 6, it is possible to use both the measurement process using the feeder-side measurement means 33 of the feeder-side resin-material distribution means 31a and the measurement process using the plate-side measurement means 36 of the receiver-side resin-material distribution means 31b.

It is also possible to adopt a configuration in which only one of the two measurement
20 processes is performed.

[0044]

(Another Means for Flattening Resin Material)

The receiver-side resin-material distribution means 31b is provided with an oscillatory leveling means (not shown) for the resin material, which functions as the
25 resin-material flattening means for oscillating (together with the resin-supplying plate 21a)

the granular resin 6 in the resin-receiving section 22 loaded from the linear oscillation feeder 35 into the resin-receiving section 22, thereby moving the granular resin 6 in the X-direction or Y-direction respectively, or in both directions simultaneously, so as to flatten the granular resin 6 in the resin-receiving section 22 and form it into a layer having a uniform thickness.

5 That is to say, in the receiver-side resin-material distribution means 31b, the granular resin 6 supplied in the resin-receiving section 22 of the resin-supplying plate 21a can be moved in the X-direction or Y-direction by oscillating the resin-supplying plate 21a with the oscillatory leveling means.

In this process, the granular resin 6 in the resin-receiving section 22 is formed into a
10 layer having a uniform thickness by moving the granular resin 6 supplied in the resin-receiving section 22 in the X-direction or Y-direction so that it becomes a flat layer.

Thus, a resin-flat-loaded plate 25 having a resin-receiving section 22 (opening section 37) supplied with a required amount of flattened granular resin 6 (a layer of the granular resin 6 having a uniform thickness) can be prepared.

15 [0045]

In the resin-material loading means 32 (linear oscillation feeder 35), a constant amount of resin per unit time can be supplied into the resin-receiving section 22 of the resin-supplying plate 21a by oscillating the granular resin 6.

In this case, the granular resin 6 loaded in the resin-receiving section 22 can be
20 formed into a layer having a uniform thickness (with a constant amount of resin per unit area) by appropriately controlling the amount of resin per unit time and the effect of oscillation on the resin-receiving section 22 (granular resin 6) by means of the oscillatory leveling means for the resin material.

The loading of the granular resin 6 into the resin-receiving section 22 of the
25 resin-supplying plate 21a may be achieved by making the granular resin 6 fall onto the

central region of the resin-receiving section 22.

In this process, the granular resin 6 loaded into the resin-receiving section 22 undergoes oscillation and moves evenly toward the peripheral region. Thus, the granular resin 6 is formed into a flat layer having a uniform thickness.

5 [0046]

If an uneven portion remains in the loaded granular resin 6 in the resin-receiving section 22 of the resin-supplying plate 21a, the uneven portion can be flattened to form the granular resin 6 into a layer with a uniform thickness by using an appropriate method for flattening the resin material, such as oscillating the resin-supplying plate 21a or using a
10 spatula.

[0047]

Although a thermosetting resin is used in the previous embodiment, it is also possible to use a thermoplastic resin.

[0048]

15 Furthermore, although a granular resin material 6 is used in the previous embodiment, it is also possible to use various forms of resin materials, such as a coarsely powdered resin (a powder-like resin material having a required distribution of grain size) or finely powdered resin (a resin material in the form of fine powder).

[0049]

20 Furthermore, in the previous embodiment, it is possible to use, for example, a silicon resin or epoxy resin as the resin material.

In the previous embodiment, it is also possible to use various kinds of resin materials, such as a transparent resin material, a semitransparent resin material, or a resin material containing a phosphorescent or fluorescent substance.

25 [0050]

Furthermore, in the resin-flat-loaded plate 25, a lid member may be provided on the upper side of the resin-receiving plate 21 so that the plate-top opening 39 (resin-receiving section 22) can be covered with the lid.

5 EXPLANATION OF NUMERALS

[0051]

- 1 ...Metal Mold for Compression-Molding Electronic Parts (Mold Assembly)
- 2 ...Fixed Upper Die
- 3 ...Movable Lower Die
- 10 4 ...Substrate-Setting Section
- 5 ...Lower-Die Cavity
- 6 ...Granular Resin Material (Granular Resin)
- 7 ...Electronic Parts
- 8 ...Substrate
- 15 9 ...Inloader
- 9a ...Plate-Attaching Section
- 9b ...Substrate-Placing Section
- 10 ...Cavity Opening
- 11 ...Mole Release Film
- 20 12 ...Resin-Molded Body
- 21 ...Resin-Receiving Plate
- 21a ...Resin-Supplying Plate
- 22 ...Resin-Receiving Section
- 23 ...Plate-Bottom Opening
- 25 24 ...Plate Periphery Section

- 25 ...Resin-Flat-Loaded Plate
- 31 ...Resin-Material Distribution Means
- 31a ...Feeder-Side Distribution Means
- 31b ...Receiver-Side Distribution Means
- 5 32 ...Resin-Material Loading Means
- 33 ...Feeder-Side Measurement Means
- 34 ...Hopper
- 35 ...Linear Oscillation Feeder
- 36 ...Plate-Side Measurement Means
- 10 37 ...Opening Section
- 38 ...Cavity-Bottom Member
- 39 ...Plate-Top Opening
- 40 ...Plate-Placing Section
- 41 ...Required Thickness (Distance)
- 15 42 ...Horizontally-Moving Flattening Mechanism

CLAIMS

1. A method for compression-molding electronic parts including steps of supplying a required amount of granular resin material or powdered resin material into a die
5 cavity covered with a mold release film and then immersing the electronic parts in a resin held in the aforementioned cavity so as to perform, in the aforementioned cavity, compression-molding of the electronic parts in a resin-molded body having a shape corresponding to a shape of the cavity, the method being characterized by including following processes:

10 preparing a resin-supplying plate having a resin-receiving section by covering a bottom side of a resin-receiving plate having an opening section corresponding to the die cavity with a mold release film;

supplying a required amount of granular resin material or powdered resin material into the resin-receiving section of the resin-supplying plate;

15 preparing a resin-flat-loaded plate in which the granular resin material or the powdered resin material in the resin-receiving section is formed into a flat layer having a uniform thickness;

placing the resin-flat-loaded plate on the die cavity so that the resin-receiving section is adjusted at a position of the die cavity with the mold release film in between;

20 covering a surface of the cavity with the mold release film; and

supplying the granular resin material or the powdered resin material from the resin-receiving section into the die cavity in the process of covering the surface of the cavity with the mold release film.

25 2. The method for compression-molding electronic parts according to claim 1,

characterized in that the process of preparing a resin-flat-loaded plate in which the granular resin material or the powdered resin material in the resin-receiving section is formed into a flat layer having a uniform thickness includes a process of moving the resin-supplying plate in an X-direction or Y-direction, while supplying the required amount of ~~resin-material~~ granular resin material or powdered resin material into the resin-receiving section of the resin-supplying plate, so as to form the granular resin material or the powdered resin material in the resin-receiving section into a flat layer having a uniform thickness.

3. The method for compression-molding electronic parts according to claim 1, characterized in that the process of preparing the resin-flat-loaded plate in which the granular resin material or the powdered resin material in the resin-receiving section is formed into a flat layer having a uniform thickness includes a process of oscillating the resin-supplying plate so as to form ~~the-resin-material~~ the granular resin material or the powdered resin material in the resin-receiving section into a flat layer having a uniform thickness.

15

4. A mold system for compression-molding electronic parts including: a metal mold for compression-molding electronic parts, the metal mold having an upper die and a lower die facing the upper die; a cavity for compression-molding; the cavity being provided in the lower die; a substrate-setting section provided in the upper die; a mold release film for covering an inner surface of the cavity of the lower die; a cavity-bottom member for pressing the resin in the cavity of the lower die; and an inloader for supplying ~~a-resin-material~~ a granular resin material or a powdered resin material and a substrate with electronic parts mounted thereon into the metal mold, characterized by comprising: a resin-receiving plate being attached to the inloader and having an opening section; a mold release film for covering a lower side of the resin-receiving plate to make the opening section function as a

resin-receiving section; and a resin-material distribution means for supplying a granular resin material or a powdered resin material into the resin-receiving section, wherein the mold release film covering the inner surface of the cavity for compression-molding and the mold release film covering the lower side of the resin-receiving plate are the same.

5

5. The mold system for compression-molding electronic parts according to claim 4, characterized in that the resin-material distribution means for supplying a granular resin material or a powdered resin material into the resin-receiving section includes a resin-material supply means for supplying a granular resin material or a powdered resin material into the resin-receiving section, a resin-material measurement means for measuring the amount of the granular resin material or the powdered resin material to be supplied into the resin-receiving section, and a resin-material flattening means for flattening the granular resin material or the powdered resin material supplied in the resin-receiving section.

15 6. The mold system for compression-molding electronic parts according to claim 5, characterized in that the resin-material flattening means is a horizontally-moving flattening mechanism for moving the resin-receiving plate in an X-direction or Y-direction.

20 7. The mold system for compression-molding electronic parts according to claim 4, characterized in that the mold release film is prepared by previously cutting a long strip of mold release film into pieces of a required length.