

## DESCRIPTION

### TITLE OF INVENTION:

5        Resin Supply Apparatus, Resin-Molded Product Manufacturing Apparatus,  
Method of Manufacturing Resin-Molded Product, and Resin Supply Method

### TECHNICAL FIELD

[0001] The present specification relates to a resin supply apparatus, a resin-molded product manufacturing apparatus, a method of manufacturing a resin-molded product, and a resin supply method.

### 10        BACKGROUND ART

[0002] As disclosed in Japanese Patent Laying-Open No. 2018-134846 (PTL 1), a resin supply apparatus that supplies a resin material to a supply target has been known.

According to PTL 1, when air is contained in a resin material supplied to a supply target, presence of air may cause occurrence of voids. According to PTL 1, by  
15        increasing a moving speed of a discharge portion (nozzle), an amount of supply of the resin material at a position thereof can be made smaller than that at another position and ejection of air from the resin material in a compression step is expedited.

### CITATION LIST

#### PATENT LITERATURE

20        [0003] PTL 1: Japanese Patent Laying-Open No. 2018-134846

### SUMMARY OF INVENTION

#### TECHNICAL PROBLEM

[0004] In supply of a resin material widely over a spread surface of a supply target, a discharge portion (nozzle) is arranged above the spread surface and the discharge  
25        portion is moved relatively to the spread surface. By continuing to discharge the resin material from the discharge portion while the discharge portion scans the spread surface, the resin material can widely be supplied over the spread surface. Attention is now paid to a state immediately after discharge of the resin material from the discharge portion.

[0005] Fig. 9 is a diagram showing a state immediately after discharge of a resin material 73 accommodated in an accommodation portion 71 over a spread surface 75 from a discharge portion 72a and start of movement of discharge portion 72a. After resin material 73 is discharged from discharge portion 72a, resin material 73 advances downward so as to sag from discharge portion 72a, and thereafter resin material 73 lands on spread surface 75 of a supply target. Resin material 73 is continuously discharged from discharge portion 72a. Movement of discharge portion 72a is started in this state (an arrow AR). Starting from a position on spread surface 75 where resin material 73 has landed, resin material 73 starts to draw a prescribed trace on spread surface 75.

[0006] In the state immediately after resin material 73 has landed on spread surface 75 of the supply target, resin material 73 has not sufficiently been fixed to spread surface 75. If movement of discharge portion 72a is started in this state, with movement of discharge portion 72a, resin material 73 may be dragged and displaced from the position on spread surface 75 where resin material 73 has first landed. In this case, it becomes difficult to uniformly supply resin material 73 over spread surface 75.

[0007] Such a phenomenon is more likely in discharge of a liquid resin material having high viscosity from a discharge portion having a small nozzle diameter. When resin material 73 having high viscosity lands on spread surface 75 as shown in Fig. 10, a contact angle  $\theta$  becomes large. When contact angle  $\theta$  is large, a contact area AA between resin material 73 and spread surface 75 is relatively small. Since adhesive force between resin material 73 and spread surface 75 accordingly also becomes weaker, with movement of the discharge portion, displacement of resin material 73 from the position on spread surface 75 where resin material 73 has first landed is more likely.

[0008] Measures against displacement of resin material 73 may include lowering a moving speed of discharge portion 72a. In an example where discharge portion 72a supplies resin material 73 while it moves at a low speed, however, there is a concern about time required for supply of resin material 73 over a wide range of spread surface

75, shortage of resin material 73 (within a cartridge set in accommodation portion 71) before supply of resin material 73 to the whole prescribed area, and resultant failure in uniform supply of resin material 73 over spread surface 75.

[0009] An object of the present specification is to disclose a resin supply apparatus, a resin-molded product manufacturing apparatus, a method of manufacturing a resin-molded product, and a resin supply method that allow supply of a resin material over a spread surface as uniformly as possible in a supply time period as short as possible.

#### SOLUTION TO PROBLEM

[0010] A resin supply apparatus in the present disclosure is a resin supply apparatus that supplies a resin material over a spread surface of a supply target. The resin supply apparatus includes an accommodation portion where the resin material is accommodated, the accommodation portion including a discharge portion that discharges the resin material, a pressing mechanism including a pressing portion to be inserted in the accommodation portion, a movement mechanism that has the discharge portion scan the spread surface by moving the discharge portion relatively to the spread surface, and a controller that controls the movement mechanism. As the pressing portion moves within the accommodation portion, the resin material within the accommodation portion is extruded from the discharge portion and the resin material lands on a discharge start point within the spread surface. The controller is configured to control the movement mechanism in a first mode in which the discharge portion moves relatively to the spread surface at a first speed after the resin material has landed on the discharge start point and a second mode in which the discharge portion moves relatively to the spread surface at a second speed higher than the first speed. The controller switches from the first mode to the second mode at a time point when a direct distance between a predetermined reference position and the discharge portion exceeds a prescribed value or at a time point of lapse of a prescribed time period from a time point of start of movement of the pressing portion for extrusion of the resin material from the discharge portion.

[0011] A resin-molded product manufacturing apparatus in the present disclosure

includes the resin supply apparatus described above.

A method of manufacturing a resin-molded product in the present disclosure uses the resin-molded product manufacturing apparatus described above. The method includes supplying, by the resin supply apparatus, the resin material to a supply target and resin molding the supply target with the resin material.

[0012] A resin supply method in the present disclosure is a resin supply method of supplying a resin material over a spread surface of a supply target. The resin supply method includes having the resin material land on a discharge start point within the spread surface, the resin material being extruded from a discharge portion as a result of movement of a pressing portion within an accommodation portion, performing a first mode in which the discharge portion supplies the resin material to the spread surface while the discharge portion moves relatively to the spread surface at a first speed after the resin material has landed on the discharge start point, and performing a second mode in which the discharge portion supplies the resin material to the spread surface while the discharge portion moves relatively to the spread surface at a second speed higher than the first speed. Switching from the first mode to the second mode is made at a time point when a direct distance between a predetermined reference position and the discharge portion exceeds a prescribed value or at a time point of lapse of a prescribed time period from a time point of start of movement of the pressing portion for extrusion of the resin material from the discharge portion.

#### ADVANTAGEOUS EFFECTS OF INVENTION

[0013] According to the technical concept disclosed herein, a resin supply apparatus, a resin-molded product manufacturing apparatus, a method of manufacturing a resin-molded product, and a resin supply method that allow supply of a resin material over a spread surface as uniformly as possible in a supply time period as short as possible can be obtained.

#### BRIEF DESCRIPTION OF DRAWINGS

[0014] Fig. 1 is a diagram showing a functional block of a resin-molded product manufacturing apparatus 1000.

Fig. 2 is a cross-sectional view showing a state before clamping, of a molding portion 80 included in resin-molded product manufacturing apparatus 1000.

Fig. 3 is a cross-sectional view showing a state after clamping, of molding portion 80 included in resin-molded product manufacturing apparatus 1000.

5 Fig. 4 is a diagram showing a flowchart of a method of manufacturing a resin-molded product by using resin-molded product manufacturing apparatus 1000.

Fig. 5 is a cross-sectional view showing a resin supply apparatus 100 included in resin-molded product manufacturing apparatus 1000.

10 Fig. 6 is a perspective view showing a manner of supply of a resin material 13 over a spread surface 60s from a discharge portion 12a of resin supply apparatus 100.

Fig. 7 is a plan view showing a manner of resin material 13 formed when discharge portion 12a is operated along a spiral trace over spread surface 60s.

Fig. 8 is a diagram showing a flowchart of a resin supply method using resin supply apparatus 100.

15 Fig. 9 is a diagram showing a state immediately after discharge of a resin material 73 accommodated in an accommodation portion 71 over a spread surface 75 from a discharge portion 72a and start of movement of discharge portion 72a.

Fig. 10 is a diagram for illustrating a large contact angle  $\theta$  when resin material 73 having high viscosity lands on spread surface 75.

## 20 DESCRIPTION OF EMBODIMENTS

[0015] An embodiment of the present disclosure will be described below. When the number, an amount, or the like is mentioned in the embodiment which will be described below, the scope of the present disclosure is not necessarily limited to the number, the amount, or the like unless otherwise specified. Each constituent element  
25 is not necessarily essential to the present disclosure unless otherwise specified. The same or corresponding elements have the same reference characters allotted and redundant description may not be repeated.

[0016] [Resin-Molded Product Manufacturing Apparatus 1000]

Fig. 1 is a diagram showing a functional block of a resin-molded product

manufacturing apparatus 1000. Fig. 2 is a cross-sectional view showing a state before clamping, of a molding portion 80 included in resin-molded product manufacturing apparatus 1000. Fig. 3 is a cross-sectional view showing a state after clamping, of molding portion 80 included in resin-molded product manufacturing apparatus 1000.

5 [0017] As shown in Fig. 1, resin-molded product manufacturing apparatus 1000 includes a substrate module 101, a press module 102, a discharge module 103, and a film module 104. A substrate 90 (Fig. 2) is carried out of substrate module 101 and a film 60 (Fig. 2) is carried out of film module 104. Discharge module 103 supplies a thermosetting resin material 13 over film 60. Press module 102 molds substrate 90  
10 with resin using liquid resin material 13 supplied over film 60 (Fig. 3).

[0018] Substrate module 101, press module 102, discharge module 103, and film module 104 are described as different modules separate from one another in resin-molded product manufacturing apparatus 1000. Each module may be configured to be attachable to and removable from another module, and the number of modules may be  
15 increased or decreased. For example, two or three discharge modules 103 may be arranged between press module 102 and film module 104.

[0019] Resin-molded product manufacturing apparatus 1000 further includes conveyance mechanisms 91 and 92. Conveyance mechanism 91 conveys substrate 90 carried out of substrate module 101 to an upper mold 81 (Fig. 2) of a molding die in a  
20 molding portion 80 (Fig. 2) of press module 102. The molding die includes upper mold 81 and a lower mold 87. With resin material 13 supplied to film 60 (supply target), resin molding is performed for a silicon wafer (substrate 90) on which a chip has been mounted. In other words, an object to be molded is, for example, what is called a thin wafer level package.

25 [0020] Conveyance mechanism 92 conveys film 60 to which resin material 13 has been discharged in discharge module 103 to lower mold 87 (Fig. 2) of the molding die in molding portion 80 of press module 102. Conveyance mechanism 92 further conveys film 60 carried out of film module 104, on which resin material 13 is not located, to discharge module 103.

[0021] [Method of Manufacturing Resin-Molded Product]

Fig. 4 is a diagram showing a flowchart of a method of manufacturing a resin-molded product by using resin-molded product manufacturing apparatus 1000. Fig. 5 is a cross-sectional view showing a resin supply apparatus 100 included in resin-molded product manufacturing apparatus 1000. The method of manufacturing a resin-molded product will be described here and a detailed configuration and operations of resin supply apparatus 100 will be described later.

[0022] Referring to Figs. 1 to 5, in the method of manufacturing the resin-molded product, initially, resin supply apparatus 100 (Fig. 5) supplies resin material 13 over film 60 (step S101). For example, conveyance mechanism 92 conveys film 60 and a tray cover 54 (Fig. 5) in a form of a frame arranged on film 60 from film module 104 to discharge module 103.

[0023] Resin supply apparatus 100 of discharge module 103 then supplies resin material 13 over film 60 within tray cover 54. Details of this operation will be described later. Conveyance mechanism 91 then conveys substrate 90 from substrate module 101 to press module 102 and sets the substrate at a lower surface of upper mold 81 of the molding die in press module 102 (step S102).

[0024] Conveyance mechanism 91 sets film 60 to which resin material 13 has been supplied, at an upper surface of lower mold 87 (step S103). Conveyance mechanism 92 conveys, together with tray cover 54, film 60 to which resin material 13 has been supplied from discharge module 103 to press module 102 and sets film 60 on which resin material 13 is located, at the upper surface of lower mold 87 of the molding die in press module 102. Conveyance mechanism 92 conveys tray cover 54 to film module 104, without setting tray cover 54 within press module 102.

[0025] As shown in Fig. 2, in molding portion 80, a fixed platen 88 in a form of a block is supported by a tie bar or a holding frame. Upper mold 81 is set at a lower side of fixed platen 88. A movable platen 86 is arranged under fixed platen 88. Lower mold 87 is set at an upper side of movable platen 86.

[0026] Lower mold 87 includes a bottom surface member 82, a side surface member

83, a plurality of elastic members 84, and a base plate 85. Lower mold 87 is provided with a recess recessed downward. Conveyance mechanism 92 sets film 60 at the upper surface of lower mold 87 such that resin material 13 on film 60 is located at a bottom surface of the recess. As shown in Fig. 2, conveyance mechanism 91 sets  
5 substrate 90 at a lower surface of upper mold 81.

[0027] Upper mold 81 and lower mold 87 are clamped by upward movement of lower mold 87 toward upper mold 81 (step S104). For example, a not-shown clamping mechanism moves movable platen 86 upward. Lower mold 87 thus moves upward toward upper mold 81. As movable platen 86 moves upward, initially, side surface  
10 member 83 in the form of the frame abuts on substrate 90 with film 60 being interposed.

[0028] Thereafter, upward movement of movable platen 86 continues. While upward movement of side surface member 83 remains stopped, bottom surface member 82 moves upward and the plurality of elastic members 84 contract. When a position of  
15 an upper surface of side surface member 83 reaches a predetermined position, movable platen 86 stops moving upward and clamping in step S104 ends.

[0029] After movement of lower mold 87 is stopped and clamping is performed, a temperature of the molding die is increased (step S105). Resin material 13 is thermosetting. Therefore, when the temperature of resin material 13 increases, resin  
20 material 13 is cured to become cured resin 18 (Fig. 3) (step S106). After standing-by until resin material 13 is cured, base plate 85 is moved downward to move lower mold 87 downward. The molds are thus opened and a resin-molded product in which the lower surface of substrate 90 is sealed with resin is manufactured (step S107).

[0030] Though an example where discharge module 103 of resin-molded product  
25 manufacturing apparatus 1000 shown in Fig. 1, the resin-molded product manufacturing apparatus including press module 102 where substrate 90 is set at upper mold 81 and the resin-molded product is manufactured as shown, for example, in Figs. 2 and 3, includes resin supply apparatus 100 in the embodiment is described above, discharge module 103 of resin-molded product manufacturing apparatus 1000 shown in

Fig. 1, the resin-molded product manufacturing apparatus including press module 102 where substrate 90 is set, for example, at lower mold 87 and the resin-molded product is manufactured, may include resin supply apparatus 100 in the embodiment above.  
[0031] [Resin Supply Apparatus 100]

5           Referring to Fig. 5, resin supply apparatus 100 supplies liquid resin material 13 over a spread surface 60s of a supply target such as film 60. Specifically, resin supply apparatus 100 includes, for example, a cartridge 10, a movement mechanism 20, a pressing mechanism 30, an opening and closing mechanism 40, a detector 50, a stage 52, and a controller 70.

10       [0032] (Cartridge 10)

          Cartridge 10 includes a lid body 11, an accommodation portion 12, and resin material 13. In accommodation portion 12, resin material 13 is accommodated, and lid body 11 is arranged on a surface of resin material 13. Lid body 11 seals resin material 13 to prevent resin material 13 from leaking from accommodation portion 12.  
15       Accommodation portion 12 of cartridge 10 is arranged inside a cylindrical portion 23 of movement mechanism 20 which will be described later. At an end of accommodation portion 12, a discharge portion 12a is provided. Cartridge 10 discharges resin material 13 through discharge portion 12a.

          [0033] (Detector 50)

20           Stage 52 is arranged under discharge portion 12a and film 60 conveyed from film module 104 is placed on stage 52. Tray cover 54 in the form of the frame is arranged on film 60. An upper surface of film 60 is spread surface 60s to which resin material 13 is to be supplied and resin material 13 is supplied to the inside of tray cover 54 on spread surface 60s. Detector 50 is connected to stage 52, and detects a weight  
25       of resin material 13 extruded from discharge portion 12a and supplied over film 60.

          [0034] (Movement Mechanism 20)

          Movement mechanism 20 includes a peripheral wall 21, a locking member 22, and cylindrical portion 23 and holds cartridge 10. A plurality of locking members 22 are provided at an inner periphery of peripheral wall 21, and cylindrical portion 23 is

locked by the plurality of locking members 22. Cartridge 10 is removably set inside cylindrical portion 23.

[0035] Movement mechanism 20 is supported such that a not-shown drive system can change a position of discharge portion 12a, and it can move discharge portion 12a, for example, in a left-right direction and an upward-downward direction within the sheet plane of Fig. 5 and a direction perpendicular to the sheet plane of Fig. 5. By moving discharge portion 12a relatively to spread surface 60s of film 60, discharge portion 12a can scan spread surface 60s.

[0036] (Pressing Mechanism 30)

Pressing mechanism 30 includes a servo motor 31 and a pressing portion 32. Pressing portion 32 is inserted into accommodation portion 12 of cartridge 10 and arranged to be in contact with lid body 11. As pressing portion 32 moves, pressing portion 32 presses resin material 13 with lid body 11 being interposed to extrude resin material 13 from discharge portion 12a of cartridge 10.

[0037] (Opening and Closing Mechanism 40)

Opening and closing mechanism 40 includes a drive portion 41 and a pair of chucks 42 and 43. Chucks 42 and 43 are arranged to open and close discharge portion 12a. Chucks 42 and 43 are configured to be able to form an open state and a closed state. As the chucks are driven by drive portion 41, switching between these states can be made.

[0038] Discharge portion 12a has, for example, a structure of a tube of a soft material through which resin material 13 can pass. As chucks 42 and 43 press the tube, switching from a state in which resin material 13 can pass therethrough (open state) to a state in which the resin material cannot pass therethrough (closed state) is made.

Opening and closing mechanism 40 allows resin material 13 extruded from discharge portion 12a to reach film 60 while chucks 42 and 43 are in the open state and prevents resin material 13 extruded from discharge portion 12a from reaching film 60 while the chucks are in the closed state.

[0039] Controller 70 is connected to movement mechanism 20, pressing mechanism 30

(servo motor 31), opening and closing mechanism 40 (drive portion 41), detector 50, and the like, and can control operating states thereof by transmitting an instruction signal to such equipment and can further perform sensing, servo control, or the like by receiving a signal from such equipment.

5 [0040] Fig. 6 is a perspective view showing a manner of supply of resin material 13 over spread surface 60s from discharge portion 12a of resin supply apparatus 100. For example, movement mechanism 20 has discharge portion 12a scan spread surface 60s along a spiral trace. Fig. 6 shows a manner of scanning by discharge portion 12a outward from a central side of a spiral.

10 [0041] Fig. 7 is a plan view showing a manner of resin material 13 formed when discharge portion 12a is operated along a spiral trace TR over spread surface 60s. Trace TR is formed around a central point A0 to spirally extend at prescribed spiral pitches. Though details will be described later, in an inner region (a range from a discharge start point A1 to a mode switching point A2) of spiral trace TR, trace TR spirally extends at a spiral pitch P1, and in an outer region (a range from mode  
15 switching point A2 to a supply end point A3) of spiral trace TR, trace TR spirally extends at a spiral pitch P2.

[0042] As pressing portion 32 (Fig. 5) moves within accommodation portion 12 as described above, resin material 13 within accommodation portion 12 is extruded from  
20 discharge portion 12a. Resin material 13 lands on discharge start point A1 (Fig. 7) within spread surface 60s. In other words, controller 70 controls movement mechanism 20, pressing mechanism 30, and the like such that resin material 13 discharged from discharge portion 12a lands on discharge start point A1.

[0043] Controller 70 is configured to control movement mechanism 20 in a first mode  
25 in which discharge portion 12a moves relatively to spread surface 60s at a first speed V1 after resin material 13 has landed on discharge start point A1 and a second mode in which discharge portion 12a moves relatively to spread surface 60s at a second speed V2 higher than first speed V1.

[0044] In the example shown in Fig. 7, spiral trace TR is formed with resin material 13.

Spiral trace TR starts from discharge start point A1, extends to mode switching point A2 as drawing a spiral shape, and further thereafter extends to supply end point A3.

In other words, controller 70 controls movement mechanism 20, pressing mechanism 30, and the like such that resin material 13 from discharge portion 12a draws the spiral shape as shown in Fig. 7 from discharge start point A1 to mode switching point A2 and draws the spiral shape as shown in Fig. 7 from mode switching point A2 to supply end point A3.

[0045] Controller 70 has movement mechanism 20 driven in the first mode until resin material 13 discharged from discharge portion 12a reaches mode switching point A2 from discharge start point A1 after resin material 13 has landed on discharge start point A1. In the first mode, discharge portion 12a moves relatively to spread surface 60s at first speed V1. A value of first speed V1 is calculated, for example, as a speed in a tangential direction of spiral trace TR.

[0046] Controller 70 further has movement mechanism 20 driven in the second mode until resin material 13 discharged from discharge portion 12a reaches supply end point A3 from mode switching point A2. In the second mode, discharge portion 12a moves relatively to spread surface 60s at second speed V2 higher than first speed V1. A value of second speed V2 is also calculated, for example, as the speed in the tangential direction of spiral trace TR.

[0047] Controller 70 switches from the first mode to the second mode at a time point when a direct distance between a predetermined reference position (central point A0 of spiral trace TR) and discharge portion 12a exceeds a prescribed value L1 (Fig. 7).

Mode switching point A2 is set at such a location. Without being limited to such a configuration, controller 70 may switch from the first mode to the second mode at a time point of lapse of a prescribed time period from a time point of start of movement of pressing portion 32 for extrusion of resin material 13 from discharge portion 12a.

[0048] (Example)

Various parameters applicable to the embodiment as described above are exemplified, for example, as below. A silicon wafer package which is an object to be

molded has a diameter of 290 mm and a thickness of 0.05 mm.

[0049] A nozzle system of discharge portion 12a is 4 mm. An amount of resin of resin material 13 with which spiral trace TR can be formed is from 6 g to 10 g. A liquid resin material, for example, having high viscosity (having a coefficient of linear expansion as large as that of the silicon wafer) can be employed as liquid resin material 13. High viscosity refers, for example, to viscosity exceeding 500 Pa•s (pascal second). A weight (rate of discharge) of resin material 13 discharged per unit time from discharge portion 12a is 0.1 g/second. The rate of discharge can be set to a constant value from start to end of discharge. A time period required for forming spiral trace TR (amount of resin/rate of discharge) is 100 seconds.

[0050] A time period (T0) from start of movement of pressing portion 32 for extrusion of resin material 13 from discharge portion 12a until discharge portion 12a starts moving in the first mode (first speed V1) is 10 seconds. A time period for which the first mode is performed, that is, a time period from start of movement of discharge portion 12a in the first mode (first speed V1) until transition to the second mode (second speed V2), is 57.5 seconds. A time period from start of movement of discharge portion 12a in the second mode (second speed V2) until discharge portion 12a reaches supply end point A3 is 32.5 seconds.

[0051] A distance between central point A0 of spiral trace TR and discharge start point A1 is 10 mm. A trace drawn, for example, as the Archimedean spiral can be adopted as spiral trace TR. A distance (prescribed value L1) between central point A0 and mode switching point A2 is 30 mm (60 mm when converted to a diameter). A distance L2 between central point A0 and supply end point A3 is 130 mm (260 mm when converted to a diameter).

[0052] First speed V1 is set to 4.3 mm/second and second speed V2 is set to 309.5 mm/second. Spiral pitch P1 is set to 10 mm and spiral pitch P2 is set to 5 mm. In other words, spiral pitch P1 while controller 70 is controlling movement mechanism 20 in the first mode is larger than spiral pitch P2 while controller 70 is controlling movement mechanism 20 in the second mode. As the spiral pitch is larger, an amount

of resin supply per unit area is smaller. As the moving speed of discharge portion 12a is higher, the amount of resin supply per unit area is smaller.

[0053] For example, when the amount of resin is smaller, a length of dischargeable resin is shorter. When a nozzle diameter of discharge portion 12a is larger, the length of dischargeable resin is shorter. When the length of dischargeable resin is shorter than a length of the spiral, discharge is completed in the middle of drawing the spiral and it becomes difficult to supply resin to the outside of a desired range. When distribution of resin is nonuniform between a central portion and the outside of a resin supply area, a thickness of the package or a margin of flatness may decrease, wire sweep due to flow of resin may occur, or defects of products such as poor appearance (flow mark) or segregation of an ingredient may occur. Therefore, various parameters are optimized in order to uniformly distribute resin material 13 within spread surface 60s. For example, in an example where discharge portion 12a moves at a high speed, the spiral pitch is desirably set to be small.

[0054] (Resin Supply Method)

Fig. 8 is a diagram showing a flowchart of a resin supply method using resin supply apparatus 100. Resin supply apparatus 100 (Fig. 5) initially reads a setting value from a reference table or the like prepared in advance (step t101 in Fig. 8).

[0055] For example, the various parameters are different between use of resin material 13 having first viscosity and use of second viscosity higher than the first viscosity. Alternatively, the various parameters are different depending not only on the type of resin material 13 but also on the nozzle diameter of discharge portion 12a, the distance between discharge portion 12a and spread surface 60s, an area of spread surface 60s, or the like. The various parameters are optimized based on conditions of supply of resin in the past or the like and stored as the reference table.

[0056] For example, in supply of resin material 13 having first viscosity over spread surface 60s, a time period from landing of resin material 13 on discharge start point A1 until switching from the first mode to the second mode is defined as a first time interval. In supply of resin material 13 having second viscosity higher than the first

viscosity over spread surface 60s, a time period from landing of resin material 13 on discharge start point A1 until switching from the first mode to the second mode is defined as a second time interval. In this case, the various parameters can be set such that the second time interval is shorter than the first time interval. In the Example  
5 above, the first time interval (a duration for which the first mode is performed) is 57.5 seconds and the second time interval (a duration for which the second mode is performed) is 32.5 seconds.

[0057] After the necessary setting value is read, movement of pressing portion 32 is started (step t102 in Fig. 8). With increase in amount of movement of pressing  
10 portion 32, resin material 13 is extruded from discharge portion 12a. While resin material 13 has not reached spread surface 60s of film 60, a value detected by detector 50 (Fig. 5) does not vary.

[0058] The fact that resin material 13 has landed on spread surface 60s of film 60 (discharge start point A1) may be obtained, for example, from a result of detection  
15 (increase in detected weight) by detector 50 (step t103 in Fig. 8). Alternatively, resin material 13 may be regarded as having landed on spread surface 60s of film 60 based on lapse of the predetermined time period from the time point of start of movement of pressing portion 32 for extrusion of resin material 13 from discharge portion 12a. In addition, optical means or the like may be used to sense landing of resin material 13 on  
20 spread surface 60s of film 60.

[0059] Thereafter, discharge portion 12a is driven to operate in the first mode and discharge portion 12a starts moving at first speed V1 (step t104 in Fig. 8). Starting from discharge start point A1, drawing of spiral trace TR with resin material 13 is started.

25 [0060] Switching from the first mode to the second mode is made at the time point when the direct distance between the predetermined reference position (central point A0 of spiral trace TR) and discharge portion 12a exceeds a prescribed radius (prescribed value L1 shown in Fig. 7) (step t105 in Fig. 8). Switching can be made, for example, based on a value outputted from an encoder or the like. Discharge

portion 12a is thus driven to operate in the second mode and discharge portion 12a starts moving at second speed V2 (step t106 in Fig. 8).

[0061] Movement of pressing portion 32 is stopped (step t108) at the time point when discharge portion 12a reaches an outermost circumference of spiral trace TR (supply end point A3) (YES in step t107 in Fig. 8). Even after movement of pressing portion 32 is stopped, resin material 13 is kept discharged from discharge portion 12a as liquid drop and hence a prescribed liquid drain operation is performed (step t109). In the liquid drain operation, any further drop of a liquid drip is stopped, for example, by moving discharge portion 12a up and down. As necessary, the weight is sensed with detector 50 or the like, and an operation to rectify shortage of the weight is performed (step t110). Resin supply is completed as set forth above. As necessary, next resin supply is performed for another film 60.

[0062] (Functions and Effects)

As described also at the beginning, in a state immediately after resin material 13 has landed on spread surface 60s of the supply target, resin material 13 has not sufficiently been fixed to spread surface 60s. If movement of discharge portion 12a is started in this state, with movement of discharge portion 12a, resin material 13 may be dragged and displaced from the position (discharge start point A1) on spread surface 60s where resin material 13 has first landed. In this case, it becomes difficult to uniformly supply resin material 13 over spread surface 60s.

[0063] Measures against displacement of resin material 13 may include lowering a moving speed of discharge portion 12a. In an example where discharge portion 12a keeps supplying resin material 13 while it moves at a low speed, however, there is a concern about time required for supply of resin material 13 over a wide range of spread surface 60s, shortage of resin material 13 (within a cartridge set in accommodation portion 12) before supply of resin material 13 to the whole prescribed area, and resultant failure in uniform supply of resin material 13 over spread surface 60s.

[0064] In contrast, in the present embodiment, controller 70 has movement mechanism 20 driven in the first mode until resin material 13 discharged from discharge portion

12a reaches mode switching point A2 from discharge start point A1 after resin material 13 has landed on discharge start point A1. In the first mode, discharge portion 12a moves relatively to spread surface 60s at first speed V1.

[0065] Controller 70 then switches from the first mode to the second mode at the time point when the direct distance between the predetermined reference position (central point A0 of spiral trace TR) and discharge portion 12a exceeds prescribed value L1 (Fig. 7). Movement mechanism 20 is driven in the second mode until resin material 13 discharged from discharge portion 12a reaches supply end point A3 from mode switching point A2. In the second mode, discharge portion 12a moves relatively to spread surface 60s at second speed V2 higher than first speed V1.

[0066] In other words, immediately after discharge, discharge portion 12a is moved at a low speed to allow resin material 13 to sufficiently be fixed onto spread surface 60s, and after the resin material is fixed, discharge portion 12a is moved at a high speed. Resin material 13 can thus be supplied as uniformly as possible over spread surface 60s in a supply time period as short as possible. Controller 70 may be configured to control movement mechanism 20 not only in two modes of the first mode and the second mode but also in a third mode in which discharge portion 12a moves relatively to spread surface 60s at a third speed different from second speed V2. Resin can also be supplied in three or more modes.

[0067] Though an embodiment of the present disclosure has been described above, it should be understood that the embodiment disclosed herein is illustrative and non-restrictive in every respect. The scope of the present disclosure is defined by the terms of the claims and is intended to include any modifications within the scope and meaning equivalent to the terms of the claims.

#### REFERENCE SIGNS LIST

[0068] 10 cartridge; 11 lid body; 12, 71 accommodation portion; 12a, 72a discharge portion; 13, 73 resin material; 18 cured resin; 20 movement mechanism; 21 peripheral wall; 22 locking member; 23 cylindrical portion; 30 pressing mechanism; 31 servo motor; 32 pressing portion; 40 opening and closing mechanism; 41 drive portion; 42,

43 chuck; 50 detector; 52 stage; 54 tray cover; 60 film; 60s, 75 spread surface; 70 controller; 80 molding portion; 81 upper mold; 82 bottom surface member; 83 side surface member; 84 elastic member; 85 base plate; 86 movable platen; 87 lower mold; 88 fixed platen; 90 substrate; 91, 92 conveyance mechanism; 100 resin supply  
5 apparatus; 101 substrate module; 102 press module; 103 discharge module; 104 film module; 1000 resin-molded product manufacturing apparatus; A0 central point; A1 discharge start point; A2 mode switching point; A3 supply end point; AA contact area; AR arrow; L1 prescribed value; L2 distance; P1, P2 spiral pitch; TR trace; V1 first speed; V2 second speed.

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## CLAIMS

[Claim 1] A resin supply apparatus that supplies a resin material over a spread surface of a supply target, the resin supply apparatus comprising:

- 5           an accommodation portion where the resin material is accommodated, the accommodation portion including a discharge portion that discharges the resin material;
- a pressing mechanism including a pressing portion to be inserted in the accommodation portion;
- a movement mechanism that has the discharge portion scan the spread surface
- 10       by moving the discharge portion relatively to the spread surface; and
- a controller that controls the movement mechanism, wherein
- as the pressing portion moves within the accommodation portion, the resin material within the accommodation portion is extruded from the discharge portion and the resin material lands on a discharge start point within the spread surface,
- 15       the controller is configured to control the movement mechanism in
- a first mode in which the discharge portion moves relatively to the spread surface at a first speed after the resin material has landed on the discharge start point, and
- a second mode in which the discharge portion moves relatively to the
- 20       spread surface at a second speed higher than the first speed, and
- the controller switches from the first mode to the second mode
- at a time point when a direct distance between a predetermined reference position and the discharge portion exceeds a prescribed value, or
- at a time point of lapse of a prescribed time period from a time point of
- 25       start of movement of the pressing portion for extrusion of the resin material from the discharge portion.

[Claim 2] The resin supply apparatus according to claim 1, wherein

with time from landing of the resin material on the discharge start point until

switching from the first mode to the second mode in supply of the resin material having first viscosity over the spread surface being defined as a first time interval and with time from landing of the resin material on the discharge start point until switching from the first mode to the second mode in supply of the resin material having second  
5 viscosity higher than the first viscosity over the spread surface being defined as a second time interval, the second time interval is shorter than the first time interval.

[Claim 3] The resin supply apparatus according to claim 1 or 2, wherein  
the movement mechanism has the discharge portion scan the spread surface  
10 along a spiral trace.

[Claim 4] The resin supply apparatus according to claim 3, wherein  
the controller switches from the first mode to the second mode at a time point  
when the direct distance between the predetermined reference position and the  
15 discharge portion exceeds the prescribed value, and  
the predetermined reference position is a central point of the spiral trace.

[Claim 5] The resin supply apparatus according to claim 3 or 4, wherein  
a spiral pitch while the controller is controlling the movement mechanism in the  
20 first mode is larger than a spiral pitch while the controller is controlling the movement mechanism in the second mode.

[Claim 6] The resin supply apparatus according to claim 5, wherein  
the controller is configured to control the movement mechanism in a third mode  
25 in which the discharge portion moves relatively to the spread surface at a third speed different from the second speed.

[Claim 7] A resin-molded product manufacturing apparatus comprising the  
resin supply apparatus according to any one of claims 1 to 6.

[Claim 8] The resin-molded product manufacturing apparatus according to claim 7, comprising a molding die for resin molding with the resin material supplied to the supply target, for a silicon wafer on which a chip has been mounted.

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[Claim 9] A method of manufacturing a resin-molded product by using the resin-molded product manufacturing apparatus according to claim 7 or 8, the method comprising:

supplying, by the resin supply apparatus, the resin material to a supply target;  
10 and  
resin molding the supply target with the resin material.

[Claim 10] A resin supply method of supplying a resin material over a spread surface of a supply target, the resin supply method comprising:

15 having the resin material land on a discharge start point within the spread surface, the resin material being extruded from a discharge portion as a result of movement of a pressing portion within an accommodation portion;

performing a first mode in which the discharge portion supplies the resin material to the spread surface while the discharge portion moves relatively to the spread  
20 surface at a first speed after the resin material has landed on the discharge start point;  
and

performing a second mode in which the discharge portion supplies the resin material to the spread surface while the discharge portion moves relatively to the spread surface at a second speed higher than the first speed, wherein

25 switching from the first mode to the second mode is made

at a time point when a direct distance between a predetermined reference position and the discharge portion exceeds a prescribed value, or

at a time point of lapse of a prescribed time period from a time point of start of movement of the pressing portion for extrusion of the resin material from the

discharge portion.