

METHOD AND DEVICE FOR MANUFACTURING LEAD FRAME

BACKGROUND

1. Technical Field

The present disclosure relates to the method and device for manufacturing a lead frame.

2. Related Art

Typically, in a known technique, a lead frame is fed forward at a predetermined pitch in a plating device, and a plating process is performed in every forward feeding. In such plating, the position of the lead frame is detected by using pilot holes formed at the lead frame so that the position of a plating film and the position of a pattern formed on the lead frame are adjusted to each other (see, e.g., JP-A-2-145799).

SUMMARY

However, according to the above-described plating process, in a case where liquid such as cleansing liquid remains in the pilot holes, detection light for detecting the position of the lead frame cannot pass through the pilot holes. For this reason, there is a probability that the position of the lead frame cannot be determined.

The present disclosure has been made in view of the above-described problem. One object of the present disclosure is to provide the method and device for manufacturing a lead frame, the method and the device being configured so that position determination for the lead frame in a plating process can be more reliably performed.

The lead frame manufacturing method according to one aspect of the present disclosure includes a conveyance step, a position determination step, and a plating step. At the conveyance step, a band-shaped lead frame with a predetermined pattern formed

thereon is conveyed in a long-side direction at a predetermined pitch. At the position determination step, the position of the lead frame conveyed at the predetermined pitch is determined by an image sensor. At the plating step, a plating film is formed on each portion of the lead frame, the each portion corresponding to the predetermined pitch.

According to one aspect of the present disclosure, position determination for the lead frame in the plating process can be more reliably performed.

BRIEF DESCRIPTION OF THE DRAWINGS

Figs. 1(a) and 1(b) are a schematic view and an enlarged view of a lead frame according to an embodiment;

Fig. 2 is a view for describing a configuration of a plating device according to the embodiment;

Fig. 3 is a block diagram of an outline configuration of a control device according to the embodiment;

Fig. 4 is a schematic view for describing the process of determining the position of the lead frame according to the embodiment;

Fig. 5 is a view for describing a plating process and a detection process for the lead frame according to the embodiment;

Fig. 6 is a view for describing details of the detection process and a correction process according to the embodiment; and

Fig. 7 is a flowchart of a process procedure of the plating process executed by the plating device according to the embodiment.

DESCRIPTION OF THE EMBODIMENTS

In the following detailed description, for purpose of explanation, numerous

specific details are set forth in order to provide a thorough understanding of the disclosed embodiments. It will be apparent, however, that one or more embodiments may be practiced without these specific details. In other instances, well-known structures and devices are schematically shown in order to simplify the drawing.

Hereinafter, the method and device for manufacturing a lead frame according to the disclosure of the present application will be described with reference to the attached drawings. Note that the present disclosure is not limited to embodiments below.

<Outline of Lead Frame>

First, an outline of a lead frame 1 according to the present embodiment will be described with reference to Figs. 1(a) and 1(b). Figs. 1(a) and 1(b) are a schematic view and an enlarged view of the lead frame 1 according to the present embodiment. The lead frame 1 illustrated in Figs. 1(a) and 1(b) is a lead frame used for manufacturing of a quad flat package (QFP) type semiconductor device.

Note that in the present embodiment, the lead frame used for manufacturing of the QFP type semiconductor device will be described. However, the present embodiment may be applied to lead frames used for manufacturing other types of semiconductor devices. The other types of semiconductor devices include, for example, a small outline package (SOP), a small outline non-leaded package (SON), and a quad flat non-leaded package (QFN).

For the lead frame 1 according to the present embodiment, a predetermined pattern is formed in such a manner that etching or stamping is performed for a metal plate. The metal plate includes, for example, copper, copper alloy, and nickel-iron alloy. As illustrated in Fig. 1(a), the lead frame 1 has a band shape as viewed in plane. In the lead frame 1, multiple unit lead frames 2 and multiple dividers 3 are alternatively

formed side by side along a long-side direction.

The unit lead frame 2 is a section corresponding to each semiconductor device manufactured using the lead frame 1. Moreover, adjacent ones of the unit lead frames 2 are divided by the divider 3. The divider 3 is, for example, formed in a slit shape extending in a short-side direction of the lead frame 1.

As illustrated in Fig. 1(b), the unit lead frame 2 has a die pad 4, multiple leads 5, die pad supporters 6, and slits 7. The die pad 4 is provided at a center portion of the unit lead frame 2. A not-shown semiconductor chip can be mounted on a front surface of the die pad 4.

The multiple leads 5 are arranged side by side at the periphery of the die pad 4. A tip end portion of each of the multiple leads 5 extends from an outer edge portion of the unit lead frame 2 toward the die pad 4. Each of these leads 5 is, via e.g., a bonding wire, electrically connected to an electrode of the semiconductor chip arranged on the die pad 4, thereby functioning as an external terminal of the semiconductor device.

The die pad supporters 6 couple the die pad 4 and the outer edge portion of the unit lead frame 2 together. That is, the die pad supporters 6 support the die pad 4 on the unit lead frame 2. The die pad supporters 6 are each provided at four corners of the die pad 4, for example.

At the unit lead frame 2, the slits 7 are, for example, formed at positions adjacent to the dividers 3. The slits 7 are provided for reducing influence of a high-temperature process (e.g., a plating process) on the adjacent unit lead frames 2 when the high-temperature process is applied to a single unit lead frame 2, for example.

As described so far, the predetermined pattern, such as the die pad 4 and the leads 5, is formed on each unit lead frame 2 in the lead frame 1. Note that although not shown in Figs. 1(a) and 1(b), pilot holes may be provided side by side at long-side

surfaces of the lead frame 1.

<Outline of Plating Device>

Subsequently, an outline of a plating device 10 according to the present embodiment will be described with reference to Fig. 2. Fig. 2 is a view for describing a configuration of the plating device 10 according to the embodiment. Fig. 2 is a view of the plating device 10 from a lateral side.

The plating device 10 includes, in the order from upstream in a process direction, a supply-side reel 20, a conveyer 30, a first imager 40, a plater 50, a second imager 60, a conveyer 70, and a winding-side reel 80. The band-shaped lead frame 1 is set on the supply-side reel 20. The plating device 10 is configured to operate the conveyer 30 and the conveyer 70, thereby allowing conveyance of the lead frame 1 to the winding-side reel 80. Thus, in description of the present embodiment, a side close to the supply-side reel 20 will be referred to as an “upstream side,” and a side close to the winding-side reel 80 will be referred to as a “downstream side.” Note that although not shown in the figure, the plating device 10 may include other steps than the plating process. The other steps than the plating process include, for example, a pre-plating step (cleansing, base plating) and a post-plating step (cleansing, rust-proofing).

The conveyer 30 and the conveyer 70 are configured to convey the lead frame 1 described with reference to Figs. 1(a) and 1(b) forward at a predetermined pitch P (see Fig. 5). Moreover, the conveyer 30 conveys the lead frame 1 while holding the lead frame 1 to pull the lead frame 1 to the upstream side. On the other hand, the conveyer 70 conveys the lead frame 1 while holding the lead frame 1 to pull the lead frame 1 to the downstream side.

Thus, predetermined tension is, between the conveyer 30 and the conveyer 70,

applied to the lead frame 1 from the upstream and downstream sides. Thus, the lead frame 1 is held without deflection.

The plater 50 is provided between the conveyer 30 and the conveyer 70. A plating mask (not shown) having a predetermined size is provided at the plater 50. With use of such a plating mask, a plating film 8 of e.g., silver plating (see Fig. 6) is formed on a predetermined region of the lead frame 1.

The plating mask according to the present embodiment has a size corresponding to the above-described predetermined pitch P. The plating film 8 is, in every forward feeding, formed on the lead frame 1 fed forward at the predetermined pitch P by the conveyers 30, 70. In other words, the length of the predetermined pitch P upon forward feeding by the conveyers 30, 70 is determined based on the size of the plating mask placed at the plater 50.

Note that at the plater 50 according to the present embodiment, the plating mask is provided on a lower side of the lead frame 1. A plating solution sprayed upward adheres to a lower surface of the lead frame 1, thereby forming the plating film 8 on the lower surface of the lead frame 1. Moreover, a not-shown electrode is provided at the plater 50. Thus, an electric field can be applied to the lead frame 1.

Moreover, in the plating device 10, the first imager 40 is provided between the conveyer 30 and the plater 50. The second imager 60 is provided between the plater 50 and the conveyer 70. The first imager 40 and the second imager 60 each include image sensors.

That is, the first imager 40 can image the lead frame 1 before the plating process by the plater 50. The second imager 60 can image the lead frame 1 after the plating process by the plater 50. Note that in the present embodiment, the second imager 60 is, as illustrated in Fig. 2, arranged on the lower side of the lead frame 1,

thereby imaging the lower surface of the lead frame 1, the plating film 8 having been formed on the lower surface.

Further, the plating device 10 includes a control device 90 configured to control each section described so far. Subsequently, a configuration of the control device 90 will be described with reference to Fig. 3.

<Configuration of Control Device>

Fig. 3 is a block diagram of an outline configuration of the control device 90 according to the embodiment. As illustrated in Fig. 3, the control device 90 has a controller 91 and a storage 92.

The controller 91 includes a central processing unit (CPU), a read only memory (ROM), a random access memory (RAM), a microcomputer, and/or various circuits. The microcomputer has an input/output port and the like. A CPU of the microcomputer is configured to read and execute a program stored in the ROM, thereby controlling the conveyer 30, the conveyer 70, the first imager 40, the plater 50, and the second imager 60, for example.

Note that such a program may be installed in the storage 92 of the control device 90 from a computer readable recording medium recording the program. The computer readable recording medium includes, for example, a hard disk (HD), a flexible disk (FD), a compact disk (CD), a magnet optical disk (MO), and a memory card.

The storage 92 is implemented by a semiconductor memory element or a storage device, for example. The semiconductor memory element includes, for example, a RAM and a flash memory. The storage device includes, for example, a hard disk and an optical disk.

The controller 91 has a position determinator 91a, a plating processor 91b, a detector 91c, and a corrector 91d. The position determinator 91a is configured to

perform, for the plating process, a position determination process for the lead frame 1 fed forward to the downstream side. The position determinator 91a performs the position determination process for accurately adjusting the position of the lead frame 1 relative to the plating mask. Subsequently, such a position determination process will be described with reference to Fig. 4.

Fig. 4 is a schematic view for describing the position determination process for the lead frame 1 according to the embodiment. Fig. 4 illustrates an example of an image captured by the first imager 40. As illustrated in Fig. 4, a position determination mark 41 is, in the plating device 10, provided at such a position that imaging by the first imager 40 is allowed. The position determination mark 41 is adjacent to the lead frame 1.

The position determinator 91a controls the first imager 40 to image the lead frame 1 and the position determination mark 41. Then, the position determinator 91a controls the conveyers 30, 70 to move the lead frame 1 while detecting a distance L1 based on the captured image. At this point, the position determinator 91a moves the lead frame 1 to the upstream or downstream side such that the distance L1 reaches a predetermined target value G. Note that the distance L1 is a distance between a predetermined section (the slit 7 in the example of Fig. 4) of the lead frame 1 and the position determination mark 41.

Then, the position of the lead frame 1 is adjusted such that the distance L1 reaches the target value G, so that the position of the lead frame 1 relative to the plating mask can be accurately adjusted. Note that the target value G can be, for example, determined based on the position of the plating film 8 (see Fig. 6) in a test sample of the lead frame 1 processed in advance by the plating device 10.

In the present embodiment, the first imager 40 as the image sensor is used, so

that the process of determining the position of the lead frame 1 is performed. Thus, according to the present embodiment, even when liquid such as cleansing liquid remains in, e.g., the pilot holes, position determination for the lead frame 1 can be more reliably performed.

Referring back to Fig. 3, the controller 91 will be continuously described. As illustrated in Fig. 5, the plating processor 91b is configured to control the plater 50 and the like, so that the plating processor 91b forms the plating film 8 (see Fig. 6) on each portion of the lead frame 1, the each portion corresponding to the predetermined pitch P. Fig. 5 is a view for describing the plating process and a detection process for the lead frame 1 according to the present embodiment.

As illustrated in Fig. 5, the plating processor 91b forms, at a single plating step, the plating film 8 on a region R(a) having a length corresponding to the predetermined pitch P. Subsequently, the plating processor 91b forms, at a single plating step, the plating film 8 on a region R(a + 1) of the lead frame 1 fed forward once at the predetermined pitch P. The region R(a + 1) is adjacent to the region R(a). Subsequently, the plating processor 91b forms, at a single plating step, the plating film 8 on a region R(a + 2) of the lead frame 1 fed forward once at the predetermined pitch P. The region R(a + 2) is adjacent to the region R(a + 1).

By sequentially performing the plating process for a predetermined region R(x) of the lead frame 1 fed forward, even the plating device 10 including the plating mask with a limited size can perform the plating process for the entire area of the band-shaped lead frame 1. Here, “x” of the region R(x) means the order of performing the plating process.

Note that in an example of Fig. 5, the plating film 8 is formed, at a single plating step, on the predetermined region R(x) including six unit lead frames 2.

However, the region $R(x)$ targeted for a single plating process is not limited to this example. The region $R(x)$ can be determined as necessary based on, e.g., the size of the plating mask.

Referring back to Fig. 3, the controller 91 will be continuously described. The detector 91c is configured to control the second imager 60 to detect a relative position shift amount A between the plating film 8 formed on the lead frame 1 and the pattern formed on the lead frame 1. In the present embodiment, the second imager 60 simultaneously images, as illustrated in Fig. 5, a tail portion of the region $R(a)$ on which the plating film 8 has been formed at a single plating step and a lead portion of the region $R(a + 1)$ on which the plating film 8 has been formed next. The tail portion is a tail portion in a plating direction. The lead portion is a lead portion in the plating direction.

Subsequently, details of the detection process according to the present embodiment will be described with reference to Fig. 6. Fig. 6 is a view for describing the details of the detection process and a correction process according to the present embodiment. Fig. 6 corresponds to the image captured by the second imager 60.

The detector 91c detects a distance L_e . The distance L_e is a distance between an end portion of the plating film 8 at the tail of the region $R(a)$ and a predetermined section (the slit 7 in an example of Fig. 6) of the pattern formed on the lead frame 1. Note that the distance L_e will be hereinafter also referred to as a “tail distance L_e .” Moreover, the detector 91c detects a distance L_f . The distance L_f is a distance between an end portion of the plating film 8 at the lead of the region $R(a + 1)$ adjacent to the region $R(a)$ and a predetermined section (the slit 7 in the example of Fig. 6) of the pattern formed on the lead frame 1. Note that the distance L_f will be hereinafter also referred to as a “lead distance L_f .”

Here, in the present embodiment, the lead distance L_f on the region $R(a + 1)$ is taken as the lead distance L_f on the region $R(a)$. Thus, in the present embodiment, the lead distance L_f and the tail distance L_e on the region $R(a)$ can be simultaneously detected.

At this point, the detector 91c calculates, from the following expression (1), the position shift amount A between the plating film 8 and the pattern formed on the lead frame 1. The detector 91c sends information on the calculated position shift amount A to the corrector 91d.

$$A = (L_e - L_f)/2 \dots (1)$$

Referring back to Fig. 3, the controller 91 will be continuously described. The corrector 91d is configured to correct the predetermined pitch P such that the position shift amount A at a subsequent plating process decreases based on the received position shift amount A . For example, the corrector 91d corrects the predetermined pitch P such that position shift between the plating film 8 and the pattern is prevented or reduced across the entirety (i.e., from the lead to the tail) of the region $R(x)$ on which the plating film 8 is formed by a single plating step. Specifically, the corrector 91d corrects the predetermined pitch P such that the lead distance L_f and the tail distance L_e on the predetermined region $R(x)$ are equal to each other in the subsequent plating process.

For example, in the example of Fig. 6, the tail distance L_e is longer than the lead distance L_f . That is, the plating film 8 formed by a single plating process shifts to the downstream side of the lead frame 1. For this reason, the corrector 91d performs such correction that the position of the plating film 8 shifts to the upstream side in the subsequent plating process.

For example, the corrector 91d corrects the target value G in the

above-described position determination process such that the lead distance L_f and the tail distance L_e are equal to each other in the subsequent plating process. Specifically, the corrector 91d corrects the target value G to a target value G_c calculated according to the following expression (2).

$$G_c = G + A \dots (2)$$

Then, the target value G is corrected to the target value G_c , and in this manner, the value of the predetermined pitch P in forward feeding by a conveyance process is corrected.

In the example of Fig. 6, the tail distance L_e is longer than the lead distance L_f . Thus, the position shift amount A has a positive value. For this reason, the target value G_c obtained by correction is greater than the target value G before correction. That is, in the position determination process illustrated in Fig. 4, position determination is performed such that the distance L_1 becomes longer.

Thus, the position of the lead frame 1 is determined to the downstream side as compared to the position before correction. This allows the position of the plating film 8 to shift to the upstream side in the subsequent plating process. Thus, correction is made such that the lead distance L_f and the tail distance L_e are equal to each other.

Note that in the example of Fig. 6, a case where the tail distance L_e is longer than the lead distance L_f has been described. On the other hand, the correction process may be performed by a similar process even in a case where the tail distance L_e is shorter than the lead distance L_f . That is, in the case where the tail distance L_e is shorter than the lead distance L_f , the position of the plating film 8 may be shifted to the downstream side in the subsequent plating process. That is, in this case, the position of the lead frame 1 may be determined to the upstream side in the subsequent plating process, and in this manner, correction may be performed such that the lead distance L_f

and the tail distance L_e are equal to each other.

In the present embodiment, correction is made by the second imager 60 as the image sensor such that position shift between the pattern and the plating film 8 formed on the lead frame 1 is prevented or reduced across the entirety of the region $R(x)$ on which the plating film 8 has been formed by a single plating step. This reduces, across the entirety of the region on which the plating film 8 is formed by a single plating step, a portion where the position of the plating film 8 greatly shifts. Thus, the plating film can be provided with high accuracy, and a yield ratio in the plating process can be improved.

Moreover, according to the present embodiment, the position shift amount A across the entirety of the predetermined region $R(x)$ can be detected by a single imaging process by the second imager 60. With this configuration, the position shift amount A can be detected in a short amount of time. Thus, the process time of the plating device 10 can be shortened.

Here, in the present embodiment, the second imager 60 preferably includes an image sensor capable of capturing a color image. With this configuration, a boundary portion between the lead frame 1 containing e.g., copper and the plating film 8 made of e.g., silver plating can be more accurately detected. That is, the second imager 60 includes the image sensor capable of capturing the color image, and therefore, the process of detecting the position shift amount A can be more accurately performed.

The second imager 60 may include an image sensor capable of capturing a black-and-white image. In a case where the second imager 60 includes the image sensor capable of capturing the black-and-white image, the brightness and the like of the image is accurately detected so that the boundary portion between the lead frame 1 and the plating film 8 can be accurately detected.

Moreover, the first imager 40 may include an image sensor capable of capturing a black-and-white image or an image sensor capable of capturing a color image. For example, the first imager 40 includes an image sensor with a high resolution, and therefore, the process of determining the position of the lead frame 1 can be more accurately performed.

<Details of Plating Process>

Subsequently, details of the plating process according to the present embodiment will be described with reference to Fig. 7. Fig. 7 is a flowchart of a process procedure of the plating process executed by the plating device 10 according to the present embodiment.

First, the controller 91 controls the conveyers 30, 70 to convey the lead frame 1 from the supply-side reel 20 to the downstream side at the predetermined pitch P (a step S10). Next, the position determinator 91a controls the first imager 40 and the conveyers 30, 70, thereby determining the position of the lead frame 1 at a predetermined position (a step S11).

Then, the plating processor 91b controls the plater 50 to perform the plating process for the predetermined region R(x) of the lead frame 1 (a step S12). Subsequently, the detector 91c controls the second imager 60 to detect the position shift amount A of the plating film 8 with respect to the pattern formed on the lead frame 1 (a step S13).

Next, the corrector 91d corrects, based on the detected position shift amount A, the value of the predetermined pitch P used in a subsequent conveyance process (a step S14). Then, the controller 91 determines whether or not the plating process has been entirely completed for the entire area of the lead frame 1 (a step S15). At this step, in a case where the plating process has been entirely completed (the step S15, Yes), the

controller 91 ends the process. On the other hand, in a case where the plating process has not been entirely completed (the step S15, No), the controller 91 returns to the process of the step S10.

Each embodiment of the present disclosure has been described above. However, the present disclosure is not limited to each embodiment described above. Various changes can be made without departing from the gist of the present disclosure. For example, the above-described embodiments describe the case where the plater 50 forms the plating film 8 on the lower surface of the lead frame 1. Instead, the plater 50 may be configured to form the plating film 8 on an upper surface of the lead frame 1. Alternatively, the lead frame 1 may be conveyed with both of the upper and lower surfaces of the lead frame 1 facing a lateral direction (a front-to-back direction in the plating process) in the plating device 10, and the plating film 8 may be formed from the lateral direction. Note that in these cases, the second imager 60 may be arranged at such a position that the surface of the lead frame 1 can be imaged by the second imager 60, the plating film having been formed on the surface.

As described above, the method for manufacturing the lead frame 1 according to one embodiment of the present disclosure includes the conveyance step (the step S10), the position determination step (the step S11), and the plating step (S12). At the conveyance step (the step S10), the band-shaped lead frame 1 on which multiple patterns (the predetermined pattern) are formed is conveyed in the long-side direction at the predetermined pitch P. At the position determination step (the step S11), the position of the lead frame 1 conveyed at the predetermined pitch P is determined by a first image sensor (the first imager 40). At the plating step (the step S12), the plate film 8 is formed on each region R(x) of the lead frame 1, the each region R(x) corresponding to the predetermined pitch P. With this configuration, the position of

the lead frame 1 can be more reliably determined at the plating step.

Moreover, the method for manufacturing the lead frame 1 according to one embodiment of the present disclosure further includes the detection step (the step S13) and the correction step (the step S14). At the detection step (the step S13), the relative first position shift amount A between the predetermined pattern formed on the lead frame 1 and the plating film 8 formed at the plating step (the step S12) is detected by a second image sensor (the second imager 60). At the correction step (the step S14), the predetermined pitch P is, based on the detected first position shift amount A, corrected such that a second position shift amount A in subsequent plating decreases. With this configuration, the yield ratio in the plating process can be improved.

Further, at the detection step (the step S13) in the method for manufacturing the lead frame 1 according to one embodiment of the present disclosure, the second image sensor (the second imager 60) simultaneously images the tail portion of the first plating film 8 formed by a single plating step (the step S12) and the lead portion of the second plating film 8 formed after the first plating film 8. With this configuration, the process time in the plating device 10 can be shortened.

In addition, at the correction step (the step S14) in the method for manufacturing the lead frame 1 according to one embodiment of the present disclosure, correction is made such that position shift between the plating film 8 and the pattern formed on the lead frame 1 is prevented or reduced across the entirety of the region R(x) where the plating film 8 is formed by a single plating step (the step S12). With this configuration, the yield ratio in the plating process can be improved.

Moreover, the device (the plating device 10) for manufacturing the lead frame 1 according to one embodiment of the present disclosure includes the conveyers 30, 70, the position determinator 91a, and the plater 50. The conveyor 30, 70 is configured to

convey, in the long-side direction at the predetermined pitch P, the band-shaped lead frame 1 with the predetermined pattern formed thereon. The position determinator 91a is configured to determine, by the first image sensor (the first imager 40), the position of the lead frame 1 conveyed at the predetermined pitch P. The plater 50 is configured to form the plating film 8 on each region R(x) of the lead frame 1, the each region R(x) corresponding to the predetermined pitch P. With this configuration, the position of the lead frame 1 can be more reliably determined at the plating step.

Those skilled in the art can easily arrive at further advantageous effects and variations. Thus, a broader aspect of the present disclosure is not limited to the specific details or the representative embodiments as illustrated and described above. Thus, various changes can be made without departing from the spirit and scope of the general concept of the invention, the spirit and scope being defined by the attached claims and equivalents thereof.

The embodiments of the present disclosure may be the following first to fourth lead frame manufacturing methods or the following first lead frame manufacturing device.

The first lead frame manufacturing method includes the conveyance step of conveying, in a long-side direction at a predetermined pitch, a band-shaped lead frame with a predetermined pattern formed thereon; the position determination step of determining, by using a first image sensor, the position of the lead frame conveyed at the predetermined pitch; and the plating step of forming a plating film on each region of the lead frame, the each region corresponding to the predetermined pitch.

The second lead frame manufacturing method is the first lead frame manufacturing method further including the detection step of detecting, by a second image sensor, a relative position shift amount between the pattern formed on the lead

frame and the plating film formed at the plating step; and the correction step of correcting, based on the detected position shift amount, the predetermined pitch such that a subsequent position shift amount decreases.

The third lead frame manufacturing method is the second lead frame manufacturing method in which at the detection step, the second image sensor simultaneously images a tail portion of the plating film formed by a single process of the plating step and a lead portion of another plating film formed after the plating film.

The fourth lead frame manufacturing method is the second or third lead frame manufacturing method in which correction is, by the correction step, made such that position shift between the pattern and the plating film becomes uniform across the entirety of a region where the plating film is formed by a single process of the plating step.

The first lead frame manufacturing device includes a conveyer configured to convey, in a long-side direction at a predetermined pitch, a band-shaped lead frame with a predetermined pattern formed thereon; a position determinator configured to determine, by using a first image sensor, the position of the lead frame conveyed at the predetermined pitch; and a plater configured to form a plating film on each region of the lead frame, the each region corresponding to the predetermined pitch.

Reference Signs List

- | | |
|----|-----------------|
| 1 | lead frame |
| 2 | unit lead frame |
| 3 | divider |
| 8 | plating film |
| 10 | plating device |

20	supply-side reel
30, 70	conveyer
40	first imager
50	plater
60	second imager
80	winding-side reel
90	control device
91	controller
91a	position determinator
91b	plating processor
91c	detector
91d	corrector

CLAIMS

1. A lead frame manufacturing method comprising:
 - a conveyance step of conveying, in a long-side direction at a predetermined pitch, a band-shaped lead frame with a predetermined pattern formed thereon;
 - a position determination step of determining, by a first image sensor, a position of the lead frame conveyed at the predetermined pitch; and
 - a plating step of forming a plating film on each region of the lead frame, the each region corresponding to the predetermined pitch.
2. The lead frame manufacturing method according to claim 1, further comprising:
 - a detection step of detecting, by a second image sensor, a relative first position shift amount between the pattern formed on the lead frame and the plating film formed at the plating step; and
 - a correction step of correcting, based on the detected first position shift amount, the predetermined pitch such that a second position shift amount in subsequent plating decreases.
3. The lead frame manufacturing method according to claim 2, wherein
 - at the detection step,
 - the second image sensor simultaneously images a tail portion of a first plating film formed by a single process of the plating step and a lead portion of a second plating film formed after the first plating film.
4. The lead frame manufacturing method according to claim 2 or 3, wherein

at the correction step, correction is made such that position shift between the pattern and the plating film is prevented or reduced across an entirety of a region where the plating film is formed by a single process of the plating step.

5. A lead frame manufacturing device comprising:

a conveyer configured to convey, in a long-side direction at a predetermined pitch, a band-shaped lead frame with a predetermined pattern formed thereon;

a position determinator configured to determine, by a first image sensor, a position of the lead frame conveyed at the predetermined pitch; and

a plater configured to form a plating film on each region of the lead frame, the each region corresponding to the predetermined pitch.