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(54) **SEMICONDUCTOR PACKAGE TEST APPARATUS AND METHOD**

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(57) **ABSTRACT**

A semiconductor package test apparatus is provided. A semiconductor package test apparatus comprises a test board including a plurality of sensors, a chamber into which the test board is loaded, and a controller configured to control a temperature of the chamber, wherein the controller adjusts the temperature using the plurality of sensors.

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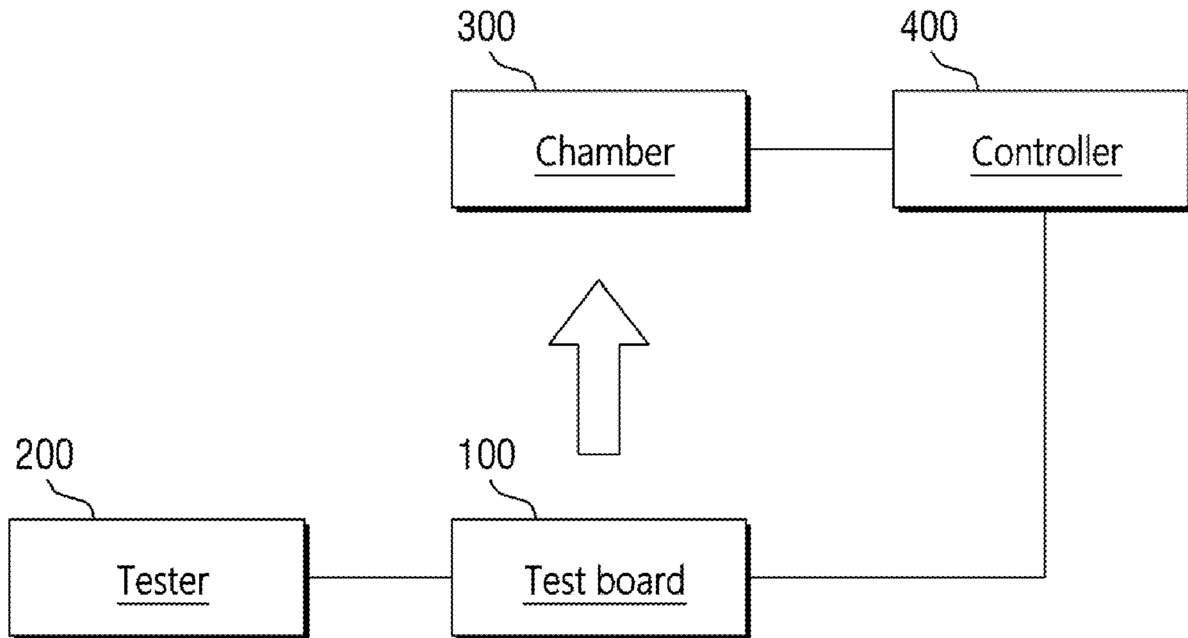


FIG. 1

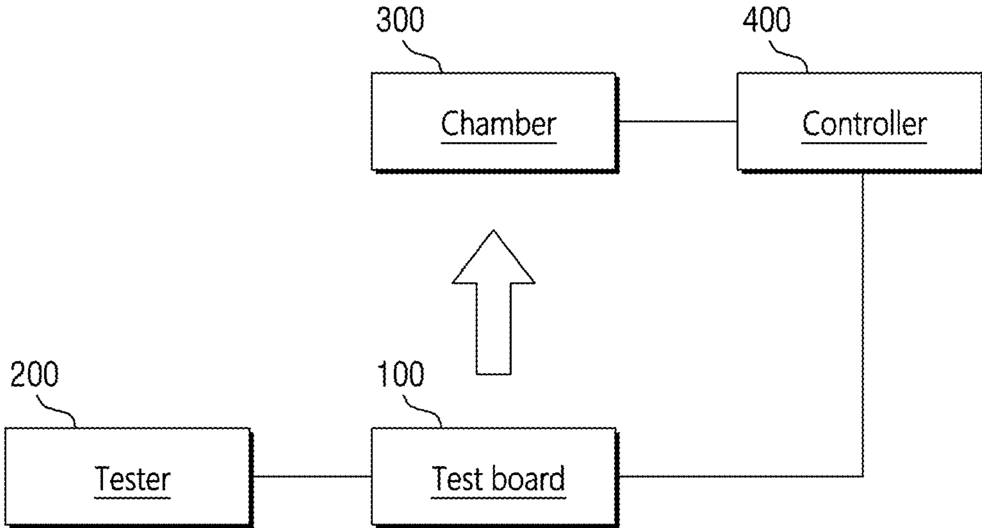


FIG. 2

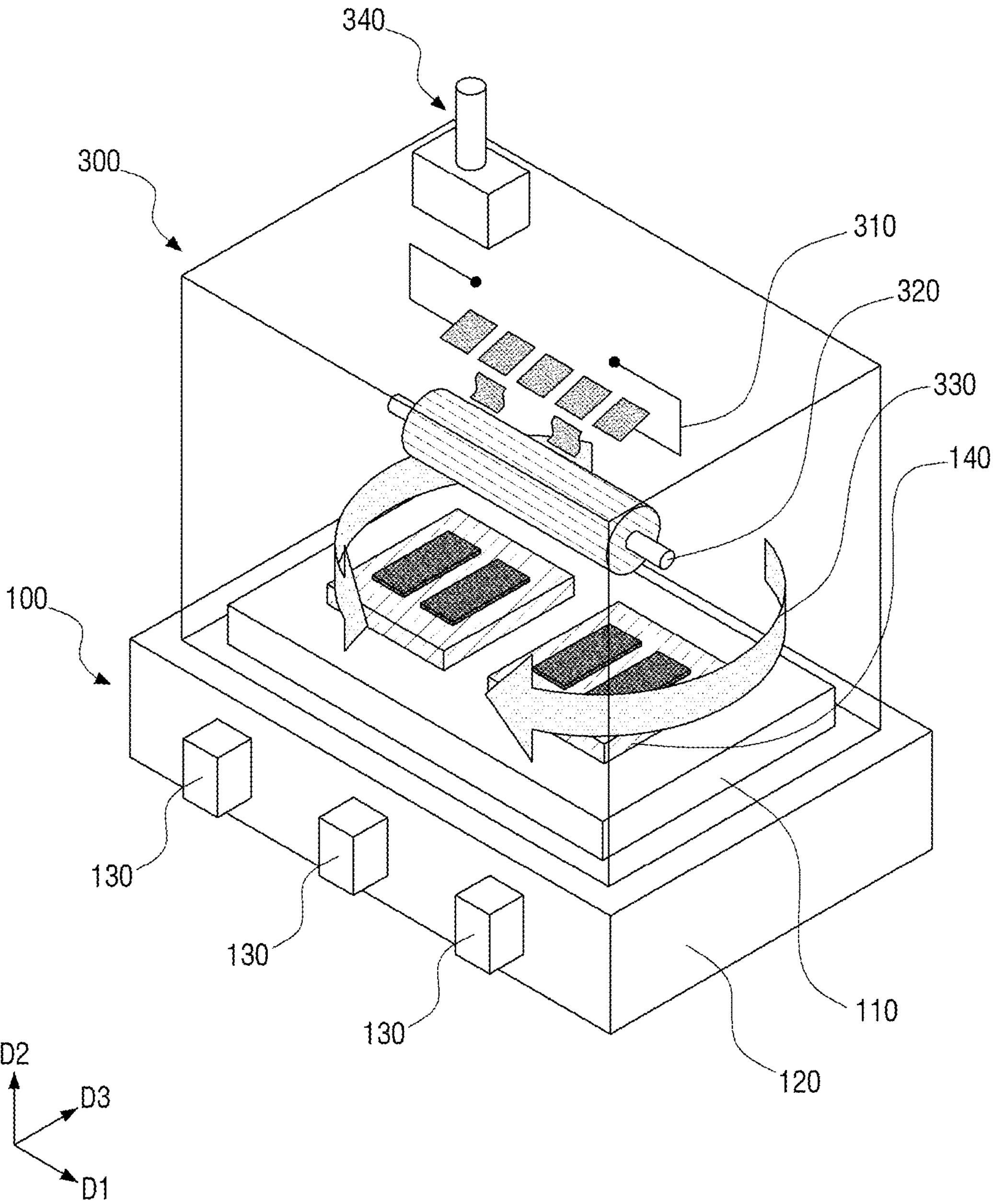


FIG. 3

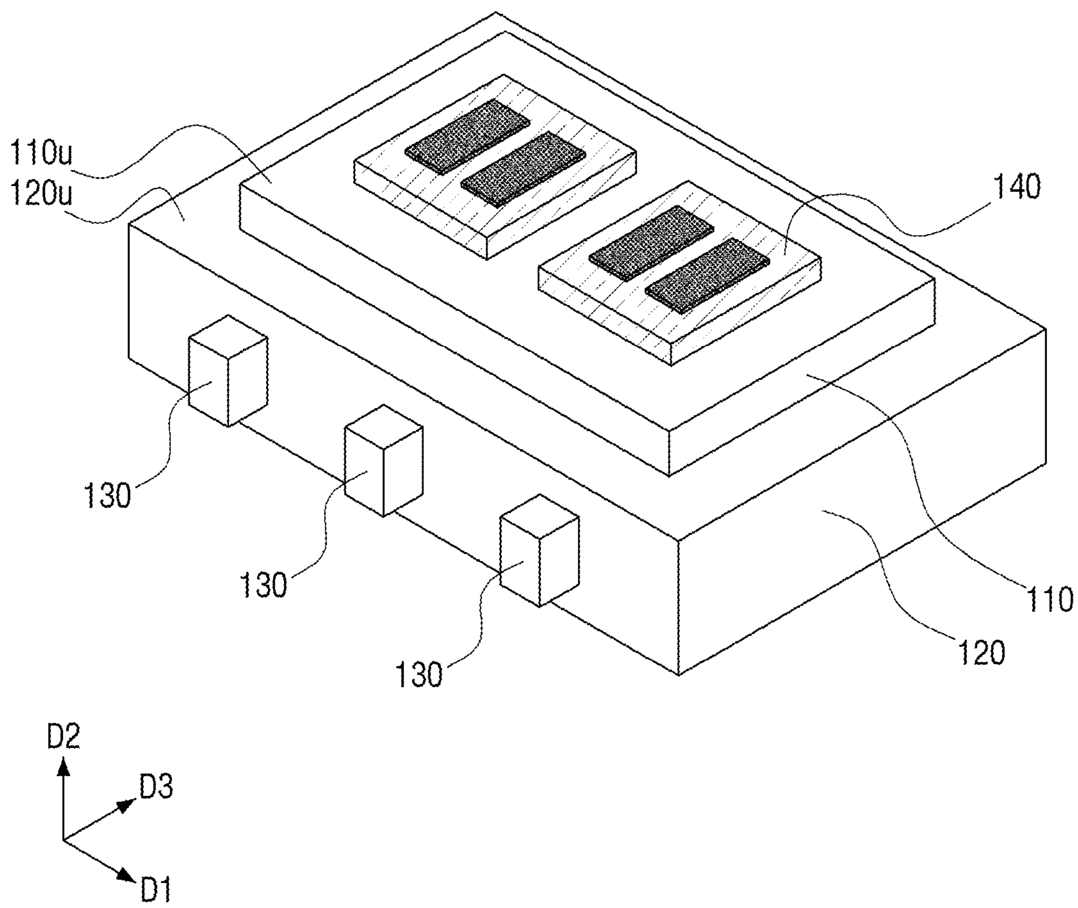
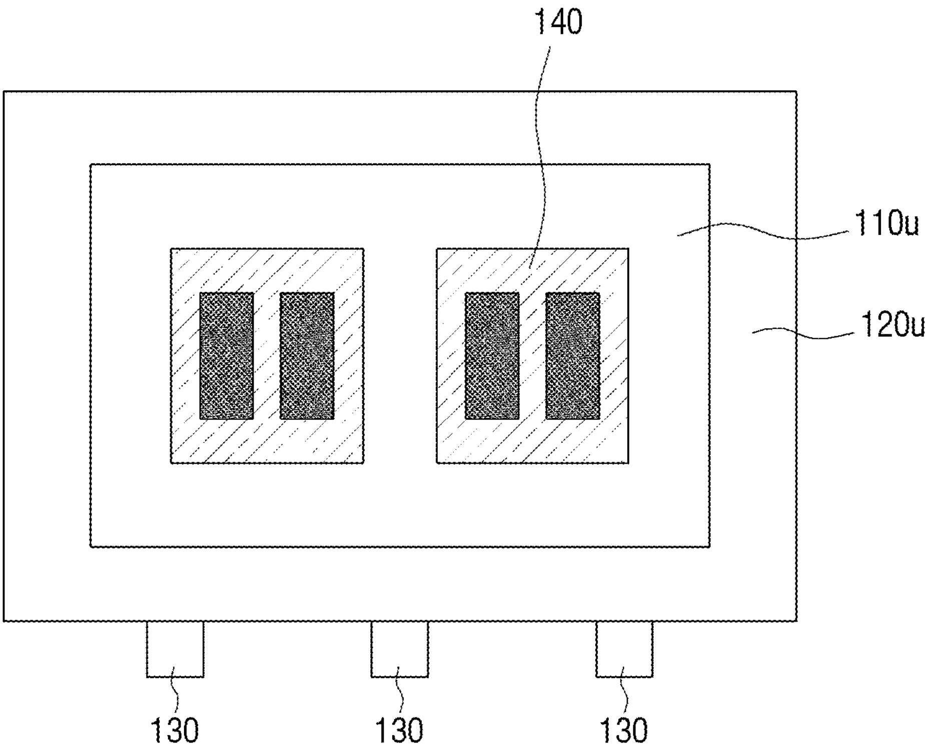


FIG. 4



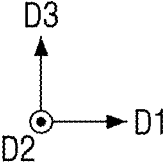
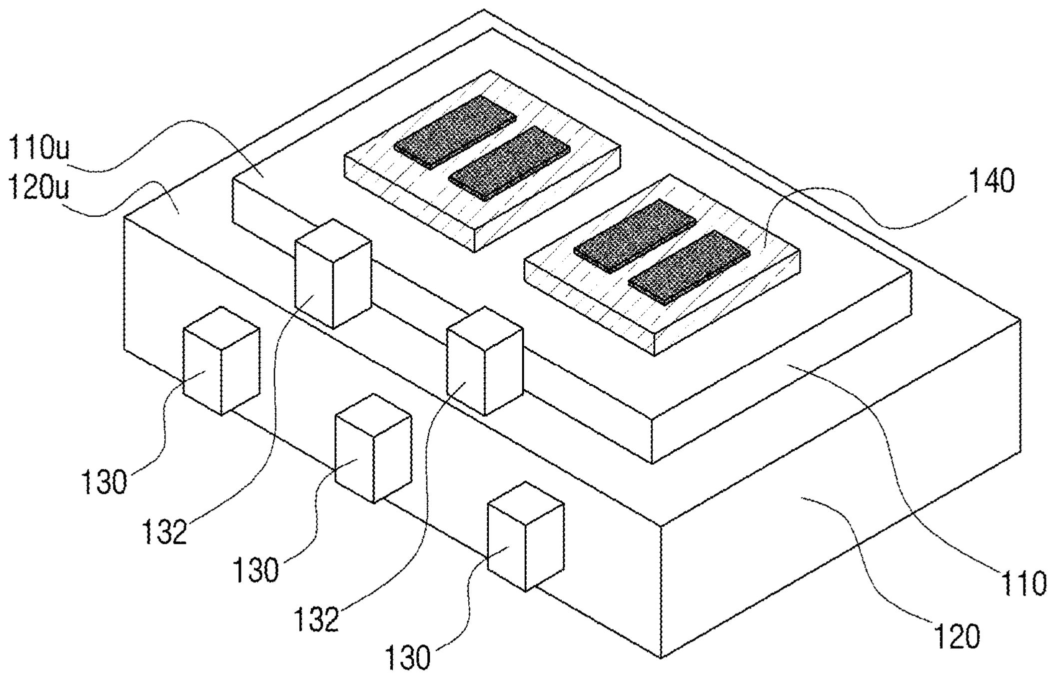


FIG. 5



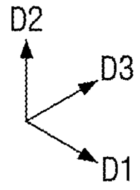
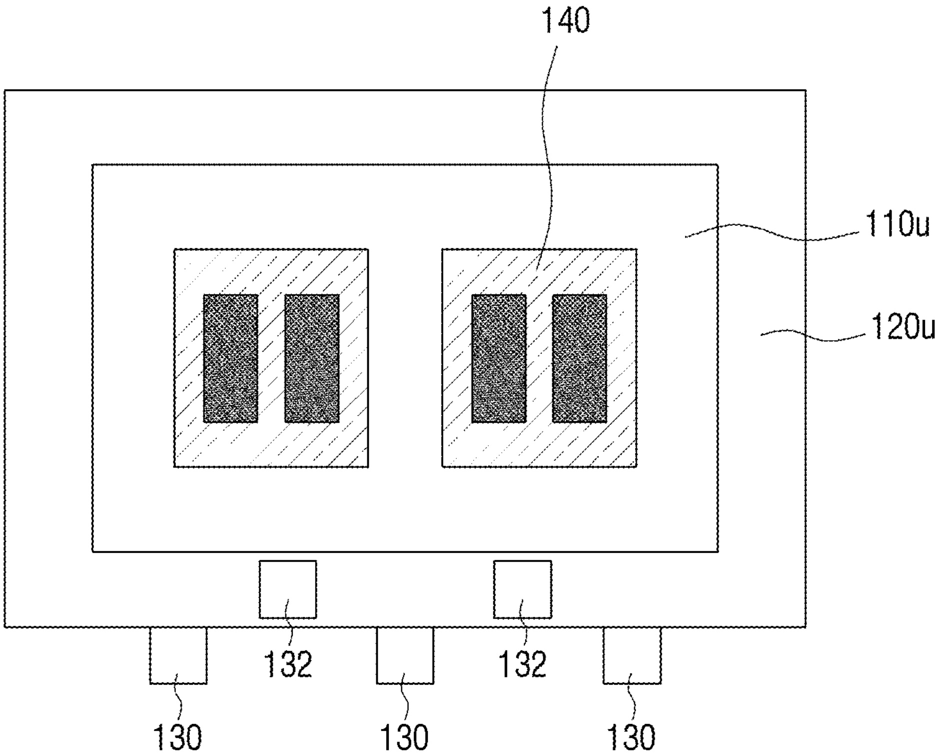


FIG. 6



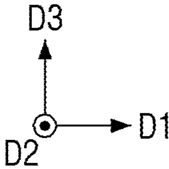
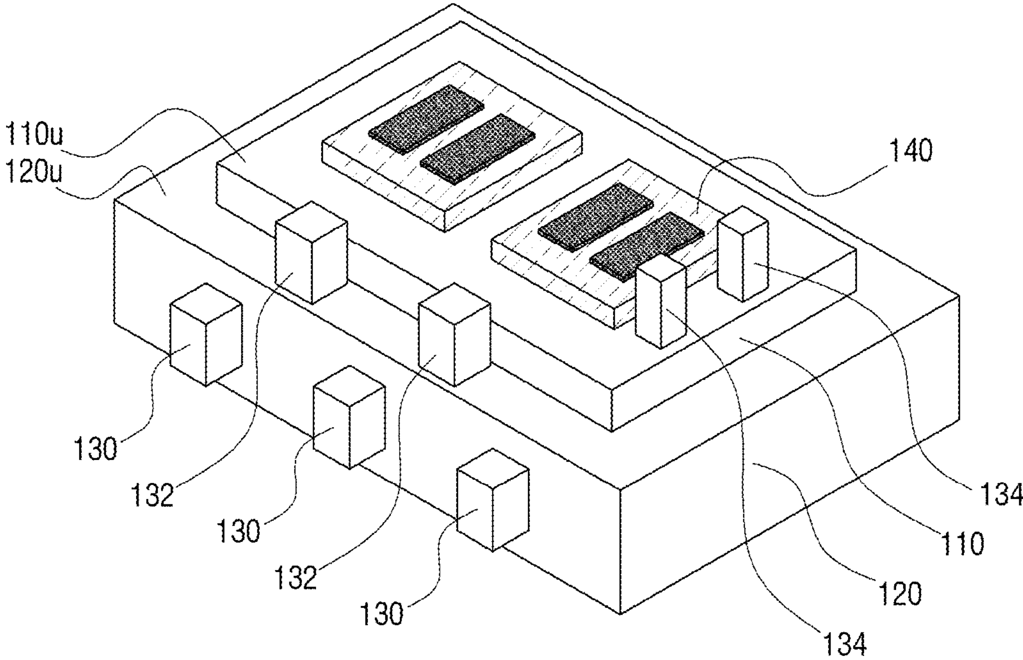


FIG. 7



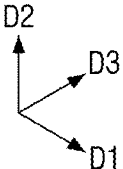
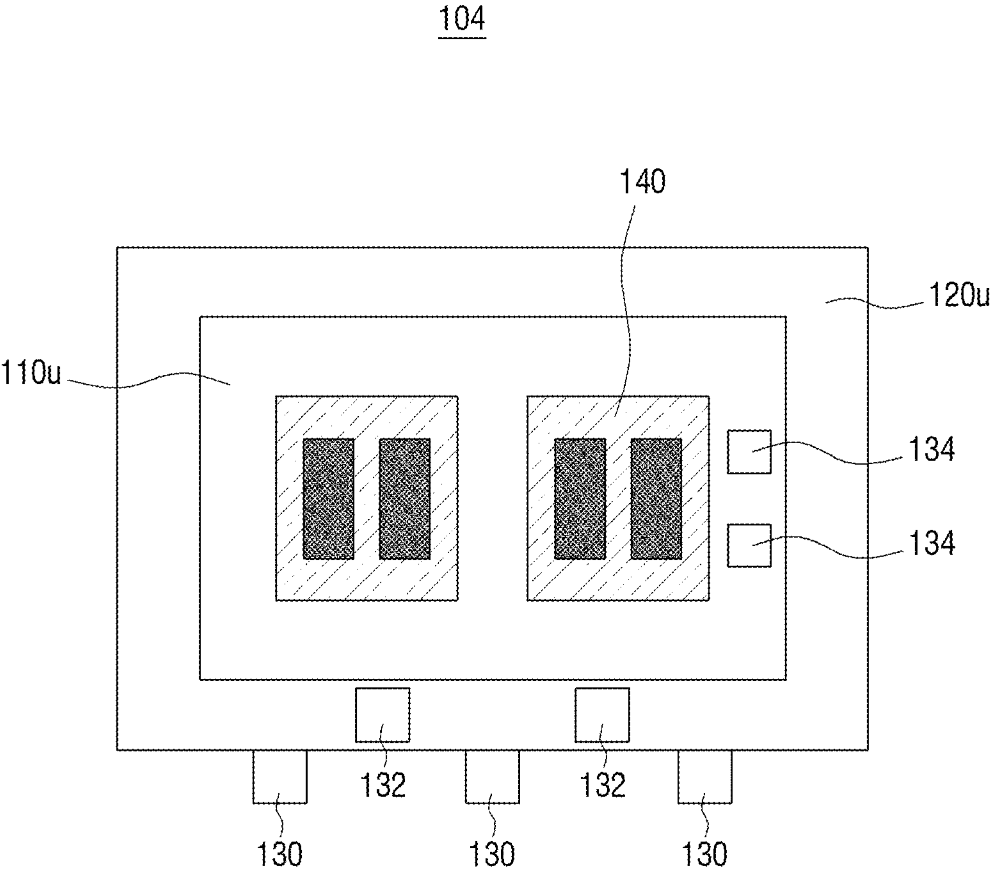


FIG. 8



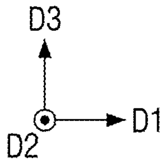
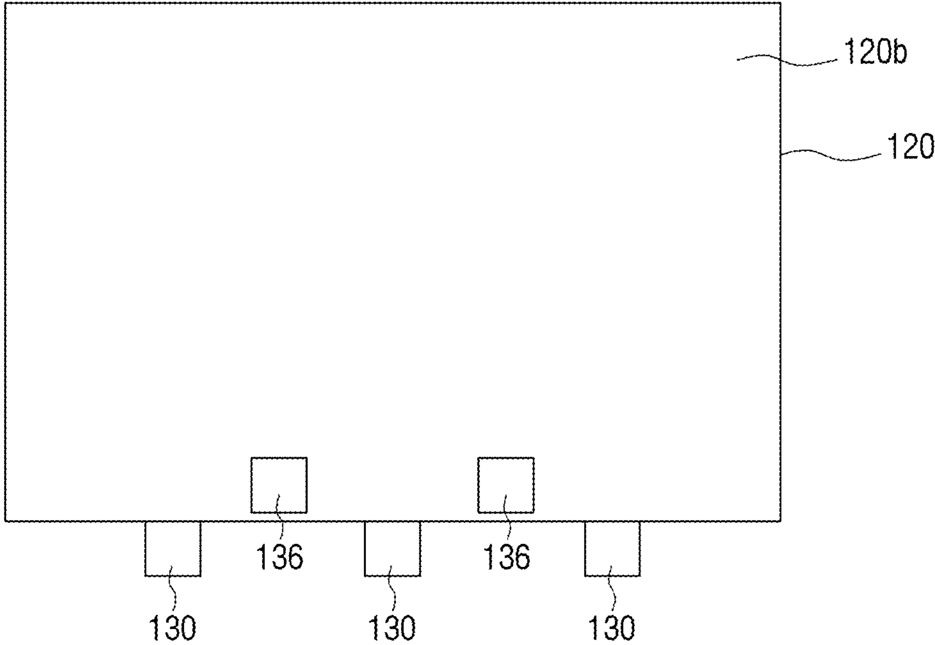


FIG. 9



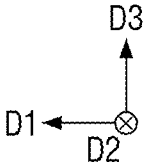
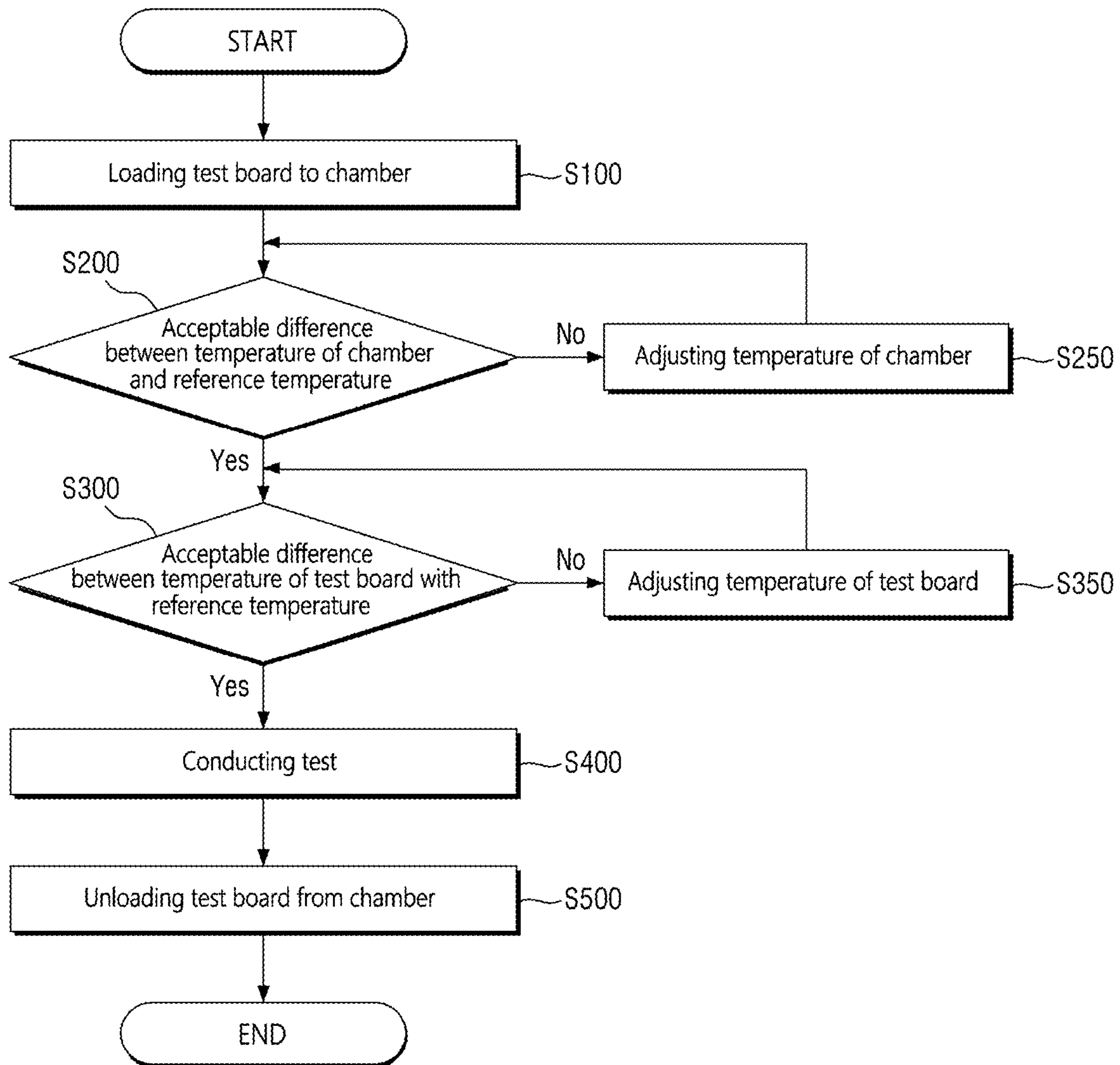


FIG. 10



SEMICONDUCTOR PACKAGE TEST APPARATUS AND METHOD

CROSS-REFERENCE TO RELATED APPLICATION

[0001] This application claims priority from Korean Patent Application No. 10-2020-0104560 filed on Aug. 20, 2020 in the Korean Intellectual Property Office, and all the benefits accruing therefrom under 35 U.S.C. 119, the contents of which in its entirety are herein incorporated by reference.

BACKGROUND

[0002] Some example embodiments relate to a semiconductor package test apparatus and/or method.

[0003] In general, semiconductor devices may be formed on a substrate such as a silicon wafer used as a semiconductor substrate by repeatedly executing a series of fabrication processes, and manufactured into semiconductor packages through a dicing process, a bonding process, and a packaging process.

[0004] The semiconductor packages manufactured as described above may be determined as defective products or non-defective products by an electrical performance test. The test process may be performed by a test robot/controller/handler for handling the semiconductor packages and a tester such as an automated test equipment (ATE) for providing test signals for testing the semiconductor packages.

[0005] The semiconductor package test process may be performed after the semiconductor packages are accommodated in insert assemblies attached to a test board and the external connection terminals of the semiconductor packages accommodated in the insert assemblies are connected to the tester. An interface board for connecting the semiconductor packages to the tester may be attached to a sidewall of a test chamber for executing the semiconductor package test process, and socket boards for connection with the semiconductor packages may be disposed on the interface board. Further, the interface board may be connected to the tester for providing test signals to the semiconductor packages.

[0006] In addition, the inside of the test chamber may be heated and/or cooled for a high-temperature test process and/or a low-temperature test process. For example, hot air for heating the semiconductor packages or cold air for cooling the semiconductor packages may be supplied into the test chamber. Accordingly, the semiconductor packages may be heated to about 125° C. or cooled to about −60° C. in some example embodiments. The temperature in the test chamber may be maintained at a preset temperature based on the temperature values measured by a plurality of temperature sensors disposed in the test chamber. However, the measured temperature values may be different from the actual temperatures of the semiconductor packages during the execution of the test process. Further improved apparatuses and/or method are being investigated.

SUMMARY

[0007] According to some example embodiments of inventive concepts, there is provided a semiconductor package test apparatus including a test board including a plurality of sensors, a chamber into which the test board is configured to be loaded, and a controller configured to control a temperature of the chamber. The controller is configured to adjust the temperature based on output from the plurality of sensors.

[0008] According to some example embodiments of inventive concepts, there is provided a semiconductor package test apparatus including a tester configured to perform a test on a semiconductor package, a test board on which the semiconductor package is configured to be mounted, the test board including a plurality of sensors, a chamber into which the test board is configured to be loaded, and a controller configured to control a temperature of the chamber. The controller is configured to adjust the temperature based on output from the plurality of sensors.

[0009] According to some example embodiments of inventive concepts, there is provided a semiconductor package test apparatus including a plurality of sensors configured to sense temperature information of a semiconductor package, a test board on which the semiconductor package is configured to be mounted, a chamber into which the test board is configured to be loaded, and a controller configured to receive the temperature information sensed by the plurality of sensors. The controller is configured to adjust a temperature of the chamber based on the temperature information.

[0010] According to some example embodiments of inventive concepts, there is provided a semiconductor package test method including mounting a semiconductor package on a test board, loading the test board into a chamber, sensing temperature information of the semiconductor package based on output from a plurality of sensors on the test board, and adjusting, by a controller, a temperature of the chamber based on the temperature information.

BRIEF DESCRIPTION OF THE DRAWINGS

[0011] The above and other aspects and features inventive concepts will become more apparent by describing in detail example embodiments thereof with reference to the attached drawings, in which:

[0012] FIG. **1** is an example block diagram illustrating a semiconductor package test apparatus according to some example embodiments;

[0013] FIG. **2** is an example perspective view illustrating a test board and a chamber of a semiconductor package test apparatus according to some example embodiments;

[0014] FIG. **3** is an example perspective view illustrating a test board of a semiconductor package test apparatus according to some example embodiments;

[0015] FIG. **4** is an example top view illustrating a test board of a semiconductor package test apparatus according to some example embodiments;

[0016] FIG. **5** is an example perspective view illustrating a test board of another semiconductor package test apparatus according to some example embodiments;

[0017] FIG. **6** is an example top view illustrating a test board of another semiconductor package test apparatus according to some example embodiments;

[0018] FIG. **7** is an example perspective view illustrating a test board of another semiconductor package test apparatus according to some example embodiments;

[0019] FIG. **9** is an example rear view illustrating a test board of another semiconductor package test apparatus according to some example embodiments;

[0020] FIG. **10** is an example flowchart illustrating a semiconductor package test method according to some example embodiments.

DETAILED DESCRIPTION OF SOME EXAMPLE EMBODIMENTS

[0021] FIG. **1** is an example block diagram illustrating a semiconductor package test apparatus according to some example embodiments.

[0022] Referring to FIG. **1**, a semiconductor package test apparatus **1** according to some example embodiments includes a test board **100**, a tester **200**, a chamber **300**, and a controller **400**.

[0023] In the semiconductor package test apparatus **1** according to some example embodiments, semiconductor packages to be tested may be mounted on the test board **100** and may be transferred to the chamber **300**. The semiconductor packages mounted on the test board **100** are loaded into the chamber **300** and are electrically tested by the semiconductor package test apparatus **1** according to some example embodiments.

[0024] At this time, the temperature in the chamber **300** may be adjusted, e.g. may be pre-adjusted, to a test temperature in order to test the semiconductor packages mounted on the test board **100**. After the electrical test of the semiconductor packages mounted on the test board **100** loaded into the chamber **300** is completed, the temperature in the chamber **300** may be recovered to another temperature, such as room temperature in order to recover the temperatures of the semiconductor packages to the room temperature. As used herein, room temperature may be 25° C. An operation of adjusting the temperature in the chamber **300** will be described in detail with reference to FIG. **2**.

[0025] FIG. **2** is an example perspective view illustrating a test board and a chamber of a semiconductor package test apparatus according to some example embodiments.

[0026] Referring to FIGS. **1** and **2**, the test board **100** may be loaded into the chamber **300**.

[0027] The test board **100** may include an upper board **110** and a lower board **120**. The shape and/or the number of boards included in the test board **100** are not limited to those illustrated in FIG. **2**. For example, the test board **100** may further include an intermediate board in addition to the upper board **110** and the lower board **120**. Further, the boards do not necessarily have a rectangular shape. A plurality of packages **140** may be mounted on the upper board **110**. The plurality of packages **140** mounted on the upper board **110** may be loaded into the chamber **300** and may be electrically tested by the semiconductor package test apparatus **1** according to some example embodiments. The structure of the test board **100** will be described in detail with reference to FIGS. **3** and **4**.

[0028] FIG. **3** is an example perspective view illustrating a test board of a semiconductor package test apparatus according to some example embodiments. FIG. **4** is an example top view illustrating a test board of a semiconductor package test apparatus according to some example embodiments.

[0029] Referring to FIGS. **1** to **4**, the lower board **120** of the test board **100** may control the semiconductor package test process of the semiconductor package test apparatus **1** according to some example embodiments. For example, the lower board **120** may generate electrical signals for testing the semiconductor packages.

[0030] The upper board **110** may be disposed on a top surface **120***u* of the lower board **120**. The upper board **110** may include a plurality of adapter boards. The upper board **110** may include, e.g., a connector for electrically connecting the semiconductor packages **140** to the lower board **120**. For example, the upper board **110** may serve as an interface between the semiconductor package test apparatus **1** according to some example embodiments and the semiconductor packages **140**.

[0031] The semiconductor packages **140** may be mounted on a top surface **110***u* of the upper board **110**. The type of arrangement in which the semiconductor packages **140** are mounted on the top surface **110***u* of the upper board **110** is not limited to that shown in the drawings.

[0032] A plurality of sensors **130** may be disposed at the lower board **120** of the test board **100** of the semiconductor package test apparatus **1** according to some example embodiments. The plurality of sensors **130** may include only temperature sensors such as thermocouples. Alternatively, the plurality of sensors **130** may include only humidity sensors. Alternatively, the plurality of sensors **130** may include both the temperature sensors and the humidity sensors. In other words, the accuracy of measurement of the actual temperatures of the semiconductor packages **140** can be improved by measuring temperatures and/or humidities at positions closest to the semiconductor packages **140** using the plurality of sensors **130** disposed at the test board **100**. Alternatively or additionally, the plurality of sensors **130** may include pressure sensors capable of determining a pressure within the chamber **300**. Sensors such as the sensors **130** may be or include thermocouples and/or smart sensors and/or microelectromechanical system (MEMS) sensors; however, example embodiments are not limited thereto. Sensors such as the plurality of sensors **130** may be adjacent to, e.g. attached to, a wall and/or a side of the test board **100**.

[0033] Any of the shape, the number, and the arrangement of the plurality of sensors **130** disposed at the test board **100** of the semiconductor package test apparatus **1** according to some example embodiments are not limited to those shown in the drawings.

[0034] Referring back to FIGS. **1** and **2**, the chamber **300** may include a heater **310**, a fan **320**, and a cooling gas supply device **340**. The arrangement and/or the shape of the heater **310**, the fan **320**, and the cooling gas supply device **340** are not limited to those shown in the drawings.

[0035] The temperature in the chamber **300** may be adjusted by at least one of the heater **310**, the fan **320**, and the cooling gas supply device **340**. For example, a target test temperature may be applied to the semiconductor package **140** by heating air, such as clean, dry air and/or air supplied from the outside, in the chamber **300** using the heater **310** and circulating the heated internal air using the fan **320** as indicated by arrows **330**. Alternatively or additionally, for example, the target test temperature may be applied to the semiconductor package **140** by supplying a cooling gas into the chamber **300** using the cooling gas supply device **340**, cooling air in the chamber **300**, and circulating the cooled internal air using the fan **320**. The cooling gas may be, consist of, or include, e.g., liquid nitrogen (LN2), but example embodiments are not limited thereto.

[0036] At this time, in order to accurately apply a target test temperature to the semiconductor package **140**, accurately detecting the temperature of the semiconductor pack-

age **140** in the chamber **300** may be necessary or desired. Therefore, the temperature in the chamber **300** may be adjusted by accurately measuring the temperature of the semiconductor package **140** using the plurality of sensors **130** disposed at the test board **100**.

[0037] Next, referring to FIGS. **1** and **2**, the temperature in the chamber **300** may be adjusted by the controller **400**. The controller **400** may be configured as, for example, a single semiconductor chip such as a field programmable gate array (FPGA), an application specific integrated circuit (ASIC), and an application processor (AP). In some example embodiments, the controller **400** may be configured using an FPGA made by Xilinx, Altera, Lattice Semiconductor, Microsemi, Achronix, QuickLogic, e2v, or Atmel. In some example embodiments, the controller **400** may be a smart controller, and/or may be or include an application-specific integrated circuit (ASIC). The controller **400** may be or include an industrial controller, such as a programmable logic controller (PLC); however, example embodiments are not limited thereto. Alternatively or additionally, the controller **400** may be configured to execute machine-readable instructions to receive environmental information from sensors such as the plurality of sensors **130**, to perform calculations based on the received environmental information, and to send signals, such as control signals, to other components such as at least one of the heater **310**, the fan **330**, or the gas supply **340** based on the results of the calculations. The controller **400** may include processing circuitry such as hardware including logic circuits; a hardware/software combination such as a processor executing software; or a combination thereof. For example, the processing circuitry more specifically may include, but is not limited to, a central processing unit (CPU) , an arithmetic logic unit (ALU), a digital signal processor, a microcomputer, a field programmable gate array (FPGA), a System-on-Chip (SoC), a programmable logic unit, a microprocessor, application-specific integrated circuit (ASIC), etc. However, the configuration type of the controller **400** is not limited thereto.

[0038] The controller **400** may be wirelessly and/or wiredly connected to the chamber **300** to control the temperature in the chamber **300**.

[0039] Additionally or alternatively, the controller **400** may be wirelessly and/or wiredly connected to the test board **100** to receive the temperature information of the semiconductor packages **140** sensed by the plurality of sensors **130** disposed at the test board **100**. The controller **400** may adjust the temperature of the chamber **300** based on the temperature information sensed by the plurality of sensors **130** disposed at the test board **100**.

[0040] For example, when the plurality of sensors **130** include temperature sensors, the temperature information sensed by the plurality of sensors **130** may be or correspond to the temperatures of the semiconductor packages **140**. At this time, the controller **400** may adjust the temperature in the chamber **300** based on the temperatures sensed by the plurality of sensors **130**. More specifically, when the controller **400** compares the temperatures sensed by the plurality of sensors **130** with a reference temperature and determines that the difference between the sensed temperatures and the reference temperature is smaller than a threshold temperature difference, e.g. an acceptable temperature difference, the temperature in the chamber **300** may be maintained. Alternatively, when the controller **400** compares the temperatures sensed by the plurality of sensors **130** with the reference temperature and determines that the difference between the sensed temperatures and the reference temperature is greater than the threshold temperature difference, e.g. the acceptable temperature difference, the temperature in the chamber **300** may be adjusted. The controller **400** may control at least one of the heater **310**, the fan **320**, or the gas supply **340** to adjust the temperature in the chamber **300**. The reference temperature may be or correspond to a reference chamber temperature, and may be variably determined, or, alternatively, predetermined; however example embodiments are not limited thereto. The threshold temperature difference may be variably determined, or alternatively, may be predetermined.

[0041] Alternatively or additionally when the plurality of sensors **130** include humidity sensors, the temperature information sensed by the plurality of sensors **130** may be or correspond to the humidity information of the semiconductor packages **140**. For example, when the plurality of sensors **130** include humidity sensors, the humidity information sensed by the plurality of sensors **130** may be the humidity in the chamber **300**. At this time, the controller **400** may adjust the temperature in the chamber **300** based on the humidities sensed by the plurality of sensors **130**. More specifically, when the controller **400** compares the humidities sensed by the plurality of sensors **130** with a reference humidity and determines that the difference between the sensed humidities and the reference humidity is smaller than a threshold humidity difference, e.g. an acceptable humidity difference, the temperature in the chamber **300** may be maintained. Alternatively, when the controller **400** compares the humidities sensed by the plurality of sensors **130** with the reference humidity and determines that the difference between the sensed humidities and the reference humidity is greater than the threshold humidity difference, e.g. the acceptable humidity difference, the temperature in the chamber **300** may be adjusted . The threshold humidity difference may be variably determined, or alternatively, may be predetermined. The controller **400** may control at least one of the heater **310**, the fan **320**, or the gas supply **340** to adjust the temperature in the chamber **300**.

[0042] Alternatively or additionally, when the plurality of sensors **130** include the temperature sensors and the humidity sensors, the temperature information sensed by the plurality of sensors **130** may be the temperatures and the humidities of the semiconductor packages **140**. At this time, the controller **400** may adjust the temperature in the chamber **300** based on the temperatures and the humidities sensed by the plurality of sensors **130**. More specifically, the controller **400** may calculate a dew point in the chamber **300** based on the temperatures and the humidities sensed by the plurality of sensors **130** and adjust the temperature in the chamber **300** based on the calculated dew point. . The controller **400** may control at least one of the heater **310**, the fan **320**, or the gas supply **340** to adjust the temperature in the chamber **300**.

[0043] The following is a detailed description of the case where the plurality of sensors **130** according to some example embodiments include the temperature sensors and the humidity sensors.

[0044] The controller **400** may calculate a dew point Tdp based on the following example Eq. 1 using a temperature T and a humidity RH sensed by the plurality of sensors **130**. The humidity RH may be an absolute humidity RH sensed by some of the plurality of sensors **130**.

$$Tdp = \frac{c\gamma m(T, RH)}{b - \gamma m(T, RH)} \quad \text{Eq. 1}$$

[0045] In the above Eq. 1, $\gamma m(T,RH)$ may be calculated by the following Eq. 2.

$$\gamma m(T, RH) = \ln\left(\frac{RH}{100} e^{\left(b - \frac{T}{d}\right)\left(\frac{T}{c+T}\right)}\right) \quad \text{Eq. 2}$$

[0046] In the above Eq. 1 and Eq. 2, b may be 18.678, c may be 257.14° C., and d may be 234.5° C.

[0047] For example, the controller **400** may adjust the temperature in the chamber **300** based on the dew point Tdp calculated by the above Eq. 1 and Eq. 2 using the temperature T and the humidity RH sensed by the plurality of sensors **130**. The equation used when the controller **400** calculates the dew point using the temperature T and the humidity RH sensed by the plurality of sensors **130** is not limited to the above-described Eq. 1 and Eq. 2.

[0048] For example, when the controller **400** compares the dew point calculated using the temperatures and the humidities sensed by the plurality of sensors **130** with a reference dew point and determines that the difference between the calculated dew point and the reference dew point is smaller than a threshold dew point difference, e.g. an acceptable dew point difference, the temperature in the chamber **300** may be maintained. Alternatively or additionally, when the controller **400** compares the dew point calculated using the temperatures and the humidities sensed by the plurality of sensors **130** with a reference dew point and determines that the difference between the calculated dew point and the reference dew point is greater than a threshold dew point difference, e.g. an acceptable dew point difference, the temperature in the chamber **300** may be adjusted. The threshold dew point difference may be determined variably, or alternatively, may be predetermined. The controller **400** may control at least one of the heater **310**, the fan **320**, or the gas supply **340** to adjust the temperature in the chamber **300**.

[0049] The controller **400** may wirelessly adjust the temperature in the chamber **300** and/or wirelessly receive the temperature information from the test board **100** using a transmission antenna and a reception antenna disposed in the controller **400**. Alternatively or additionally, the controller **400** may perform wireless communication through a transmission/reception antenna. The wireless communication of the controller **400** may be performed by, e.g., infrared data association (IrDA), radio frequency identification (RFID), Zigbee, Bluetooth, Wi-Fi, or ultra-wideband (UWB). However, the wireless communication of the controller **400** is not limited thereto.

[0050] The test board **100** may receive a signal from the tester **200** to electrically test the semiconductor package.

[0051] The tester **200** may be, include, or correspond to, e.g., a computer system. However, the tester **200** is not limited thereto, and may be any electronic device such as a portable computer, a personal mobile terminal (PDA), a mobile phone, a repeater, an access point (AP), a portable electronic device, or the like capable of transmitting and receiving data to and from an external device (e.g., the test board **100**). When the tester **200** is a computer system, the tester **200** may transfer a control signal and data among a CPU, a RAM, and a wireless interface through an internal bus. In some example embodiments, a wireless interface may be a SATA interface (SATA I/F), or may include a wired standard interface device supporting ATA, SATA1, SATA2, and SAS protocols and a wireless interface device connected thereto. The tester **200** is not necessarily the above-described computer system, and may be any electronic device capable of wirelessly transmitting and receiving data to and from an external device (e.g., the test board **100**).

[0052] Hereinafter, test boards of other semiconductor package test apparatuses according to some example embodiments will be described by way of example.

[0053] FIG. **5** is an example perspective view illustrating a test board of another semiconductor package test apparatus according to some example embodiments. FIG. **6** is an example top view illustrating a test board of another semiconductor package test apparatus according to some example embodiments.

[0054] Referring to FIGS. **5** and **6**, unlike the test board **100** of FIG. **2**, a test board **102** of another semiconductor package test apparatus according to some example embodiments may further include a plurality of sensors **132** disposed on the top surface **120***u* of the lower board **120**.

[0055] For example, the test board **100** of FIG. **2** may include the plurality of sensors **130** arranged in a first direction D**1** and/or a third direction D**3** of the lower board **120**, whereas the test board **102** of FIGS. **5** and **6** may further include the plurality of sensors **132** arranged in a second direction D**2** of the lower board **120**.

[0056] Therefore, the semiconductor package test apparatus including the test board **102** of FIGS. **5** and **6** according to some example embodiments can detect the temperature of the semiconductor package **140** more accurately.

[0057] FIG. **7** is an example perspective view illustrating a test board of another semiconductor package test apparatus according to some example embodiments. FIG. **8** is an example top view illustrating a test board of another semiconductor package test apparatus according to some example embodiments.

[0058] Referring to FIGS. **7** and **8**, unlike the test board **102** of FIGS. **5** and **6**, a test board **104** of another semiconductor package test apparatus according to some example embodiments may further include a plurality of sensors **134** disposed on the top surface **110***u* of the upper board **110**.

[0059] For example, the test board **102** of FIGS. **5** and **6** may include the plurality of sensors **130** arranged in the first direction D**1** and/or the third direction D**3** of the lower board **120** and the plurality of other sensors **132** arranged in the second direction D**2** of the lower board **120**, whereas the test board **104** of FIGS. **7** and **8** may further include the plurality of sensors **134** arranged in the second direction D**2** of the upper board **110**.

[0060] Therefore, the semiconductor package test apparatus including the test board **104** of FIGS. **7** and **8** according to some example embodiments can detect the temperature of the semiconductor package **140** more accurately.

[0061] FIG. **9** is an example rear view illustrating a test board of another semiconductor package test apparatus according to some example embodiments.

[0062] Referring to FIG. **9**, unlike the test board **104** of FIGS. **7** and **8**, a test board **106** of another semiconductor package test device according to some example embodiments may further include a plurality of sensors **136** disposed on a bottom surface **120***b* of the lower board **120**.

[0063] For example, the test board **104** of FIGS. **7** and **8** includes the plurality of sensors **130** arranged in the first direction D**1** and/or the third direction D**3** of the lower board **120**, the plurality of other sensors **132** arranged in the second direction D**2** of the lower board **120**, and the plurality of other sensors **134** arranged in the second direction D**2** of the upper board **110**, whereas the test board **106** of FIG. **9** may further include the plurality of sensors **136** arranged on the bottom surface **120*b*** of the lower board **120**.

[0064] Therefore, the semiconductor package test apparatus including the test board **106** of FIG. **9** according to some example embodiments can detect the temperature of the semiconductor package **140** more accurately.

[0065] The arrangement and/or the number of the plurality of sensors are not limited to those shown in the drawings. The arrangement and/or the number of the plurality of sensors are not limited as long as they are disposed at the test board **100**.

[0066] FIG. **10** is an example flowchart illustrating a semiconductor package test method according to some example embodiments.

[0067] A semiconductor package test method of the semiconductor package test apparatus **1** shown in FIGS. **1** and **2** according to some example embodiments will be described with reference to FIGS. **1**, **2**, and **10**. For reference, the semiconductor package test method of FIG. **10** according to some example embodiments may also be performed by the semiconductor package test apparatus according to some other embodiments described above.

[0068] First, the test board on which the semiconductor package **140** is mounted is loaded into the chamber **300** (step S**100**). Before, simultaneously, or after step S**100**, the controller **400** compares the temperature in the chamber **300** with the reference temperature to determine whether or not the difference between the temperature in the chamber **300** and the reference temperature is within a threshold or an acceptable range (step S**200**). The threshold or acceptable range may be variably determined, or alternatively, may be predetermined. The controller **400** may determine the temperature in the chamber based on a temperature sensor located on, or, alternatively, not located on the test board **100**.

[0069] It is assumed that the controller **400** determines that the difference between the temperature in the chamber **300** and the reference temperature (e.g. the reference chamber temperature) is not within the threshold or acceptable range (No). The controller **400** adjusts the temperature in the chamber **300** (step S**250**). Then, for example at a later time, e.g. a time determined based on the difference between the temperature in the chamber **300** and the reference temperature, the controller **400** compares the temperature in the chamber **300** with the reference temperature again to determine whether or not the difference between the temperature in the chamber **300** and the reference temperature, e.g. the reference chamber temperature, is within the threshold or acceptable range (step S**200**).

[0070] When the controller **400** determines that the difference between the temperature in the chamber **300** and the reference temperature is within the threshold or acceptable range, the controller **400** receives the temperature information of the semiconductor package **140** from the plurality of sensors **130** disposed at the test board **100** and compares the received temperature information with the reference temperature information (step S**300**).

[0071] For example, when the plurality of sensors **130** include temperature sensors, the temperature information sensed by the plurality of sensors **130** may be or correspond to the temperatures of the semiconductor packages **140**. At this time, the controller **400** may adjust the temperature in the chamber **300** based on the temperatures sensed by the plurality of sensors **130**. More specifically, when the controller **400** compares the temperatures sensed by the plurality of sensors **130** with the reference temperature and determines that the difference between the sensed temperatures and the reference temperature is less than the threshold temperature difference, e.g. the acceptable temperature difference (Yes), the temperature in the chamber **300** and/or the temperature of the test board **100** are maintained and, then, the test may be conducted (step S**400**). Alternatively, when the controller **400** compares the temperatures sensed by the plurality of sensors **130** with the reference temperature and determines that the difference between the sensed temperatures and the reference temperature is greater than the threshold temperature difference, e.g. the acceptable temperature difference (No), the temperature in the chamber **300** and/or the temperature of the test board **100** may be adjusted (step S**350**). The controller **400** may control at least one of the heater **310**, the fan **320**, or the gas supply **340** to adjust the temperature in the chamber **300** and/or the temperature of the test board **100**. The reference temperature used in the comparison of the test board **100** may be the same as, or different from, the reference temperature used in the comparison of the chamber **300**.

[0072] Alternatively or additionally, when the plurality of sensors **130** include humidity sensors, the temperature information sensed by the plurality of sensors **130** may be or correspond to the humidities of the semiconductor packages **140**. At this time, the controller **400** may adjust the temperature in the chamber **300** based on the humidities sensed by the plurality of sensors **130**. More specifically, when the controller **400** compares the humidities sensed by the plurality of sensors **130** with the reference humidity and determines that the difference between the sensed humidities and the reference humidity is smaller than the threshold humidity difference, e.g. the acceptable humidity difference (Yes), the temperature in the chamber **300** and/or the temperature of the test board **100** are maintained and, then, the test may be conducted (step S**400**). Alternatively, when the controller **400** compares the humidities sensed by the plurality of sensors **130** with the reference humidity and determines that the difference between the sensed humidities and the reference humidity is greater than the threshold humidity difference, e.g. the acceptable humidity difference (No), the temperature in the chamber **300** and/or the temperature of the test board **100** may be adjusted (step S**350**). The reference humidity may be variably determined, or, alternatively, may be predetermined.

[0073] When the plurality of sensors **130** includes the temperature sensors and the humidity sensors, the temperature information sensed by the plurality of sensors **130** may be the temperatures and the humidities of the semiconductor packages **140**. At this time, the controller **400** may adjust the temperature in the chamber **300** based on the temperatures and the humidities sensed by the plurality of sensors **130**. More specifically, the controller **400** may calculate a dew point in the chamber **300** based on the temperatures and the humidities sensed by the plurality of sensors **130** and adjust the temperature in the chamber **300** based on the calculated

dew point. The controller **400** may control at least one of the heater **310**, the fan **320**, or the gas supply **340** to adjust the temperature in the chamber **300**. Then, when the controller **400** compares the dew point calculated using the temperatures and the humidities sensed by the plurality of sensors **130** with the reference dew point and determines that the difference between the calculated dew point and the reference dew point is smaller than the threshold dew point difference, e.g. the acceptable dew point difference (Yes), the temperature in the chamber **300** and/or the temperature of the test board **100** are maintained and, then, the test may be conducted (step S**400**). Alternatively, when the controller **400** compares the dew point calculated using the temperatures and the humidities sensed by the plurality of sensors **130** with the reference dew point and determines that the difference between the calculated dew point and the reference dew point is greater than the threshold dew point difference, e.g. acceptable dew point difference (No), the temperature in the chamber **300** and/or the temperature of the test board **100** may be adjusted (step S**350**).

[0074] When the test board **100** on which the tested semiconductor package **140** is mounted is unloaded from the chamber **300**, the test may be completed.

[0075] Those of ordinary skill in the art will appreciate that many variations and/or modifications can be made to example embodiments without substantially departing from the principles of inventive concepts. Therefore, example embodiments of inventive concepts are used in a generic and descriptive sense only and not for purposes of limitation.

1. A semiconductor package test apparatus comprising:

a test board including a plurality of sensors;

a chamber into which the test board is configured to be loaded; and

a controller configured to control a temperature of the chamber,

wherein the controller is configured to adjust the temperature based on output from the plurality of sensors.

2. The semiconductor package test apparatus of claim **1**, wherein the plurality of sensors include a temperature sensor and a humidity sensor.

3. The semiconductor package test apparatus of claim **2**, wherein the controller is configured to calculate a dew point of the test board using a temperature of the test board and a humidity of the test board, the temperature of the test board measured by the temperature sensor and the humidity of the test board measured by the humidity sensor.

4. The semiconductor package test apparatus of claim **3**, wherein the controller is configured to compare the dew point with a reference dew point, and

in response to a difference between the dew point and the reference dew point being greater than a threshold dew point difference, the controller is configured to adjust the temperature.

5. The semiconductor package test apparatus of claim **1**, wherein the controller is configured to compare a temperature of the chamber with a reference temperature, and

in response to a difference between the temperature of the chamber and the reference temperature being greater than a threshold temperature difference, the controller is configured to adjust the temperature.

6. The semiconductor package test apparatus of claim **1**, wherein the plurality of sensors are on a side surface of the test board.

7. The semiconductor package test apparatus of claim **1**, wherein the controller is configured to measure a temperature of the test board based on output from at least one of the plurality of sensors,

the controller is configured to compare the temperature of the test board with a reference board temperature, and

in response to a difference between the temperature of the test board and the reference board temperature being greater than a threshold board temperature difference, the controller is configured to adjust the temperature of the test board.

8. A semiconductor package test apparatus comprising:

a tester configured to perform a test on a semiconductor package;

a test board on which the semiconductor package is configured to be mounted, the test board including a plurality of sensors;

a chamber into which the test board is configured to be loaded; and

a controller configured to control a temperature of the chamber,

wherein the controller is configured to adjust the temperature based on output from the plurality of sensors.

9. The semiconductor package test apparatus of claim **8**, wherein the plurality of sensors include a temperature sensor and a humidity sensor.

10. The semiconductor package test apparatus of claim **9**, wherein the controller is configured to calculate a dew point of the test board using a temperature of the test board and a humidity of the test board, the temperature of the test board measured by the temperature sensor and the humidity of the test board measured by the humidity sensor.

11. The semiconductor package test apparatus of claim **10**, wherein the controller is configured to compare the dew point with a reference dew point, and

in response to a difference between the dew point and the reference dew point being greater than a threshold dew point difference, the controller is configured to adjust the temperature.

12. The semiconductor package test apparatus of claim **8**, wherein the controller is configured to compare a temperature of the chamber with a reference temperature, and

in response to a difference between the temperature of the chamber and the reference temperature being greater than a threshold temperature difference, the controller is configured to adjust the temperature.

13. The semiconductor package test apparatus of claim **8**, wherein the plurality of sensors are on a side surface of the test board.

14. The semiconductor package test apparatus of claim **8**, wherein the controller is configured to measure a temperature of the test board based on output from the plurality of sensors,

the controller is configured to compare the temperature of the test board with a reference board temperature, and

in response to a difference between the temperature of the test board and the reference board temperature being greater than a threshold board temperature difference, the controller is configured to adjust the temperature of the test board.

15.-**20**. (canceled)

21. A semiconductor package test method comprising:

mounting a semiconductor package on a test board;

loading the test board into a chamber;

sensing temperature information of the semiconductor package based on output from a plurality of sensors on the test board; and

adjusting, by a controller, a temperature of the chamber based on the temperature information.

22. The semiconductor package test method of claim **21**, wherein the sensing of the temperature information of the semiconductor package using the plurality of sensors comprises,

measuring a humidity of the semiconductor package.

23. The semiconductor package test method of claim **22**, further comprising:

calculating, by the controller, a dew point of the semiconductor package using the temperature and the humidity;

comparing, by the controller, the dew point with a reference dew point; and

in response to a difference between the dew point and the reference dew point being greater than a threshold dew point difference, adjusting, by the controller, the temperature of the chamber.

24. The semiconductor package test method of claim **21**, wherein the adjusting of the temperature by the controller comprises,

comparing the temperature with a reference temperature, and

in response to a difference between the temperature and the reference temperature being greater than a threshold temperature difference, adjusting the temperature.

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