CLAIMS

1. A burn-in apparatus for performing burn-in process on semiconductor devices or integrated circuits, the apparatus comprising:

a burn-in chamber having at least one side opening, at least one base opening, and a set of receiving connectors arranged in the chamber;

at least one door or cover adapted to close the side opening;

at least one interchangeable frame which is movable through the side opening and removably dockable in the chamber to close the base opening, each frame having a thermal insulation base having a first and a second side, and a rack arranged at the first side of the thermal insulation base and supporting a set of burn-in boards; and

a plurality of cooperating alignment elements respectively arranged at the frame and the chamber, and configured to progressively and movably couple to each other to lift the frame to bring the set of burn-in boards that are supported by the rack into alignment for insertion into the set of receiving connectors in the chamber and to close the base opening by arranging at least the thermal insulation base of the frame in the base opening of the chamber, thereby removably docking the frame in the chamber,

wherein when the side opening is closed and each frame is removably docked in the chamber, a thermal insulation of the chamber is completed thereby defining a thermal zone configured to be subject to burn-in condition provided by the chamber, such that the rack, the set of burn-in boards and the first side of the thermal insulation base are in the thermal zone while the second side of the thermal insulation base is outside the thermal zone.

2. The burn-in apparatus of claim 1, wherein each frame further includes wheels which are manual or power assisted or adapted to be used with an autonomous guided vehicle (AGV), or a non-wheel arrangement which is adapted to be used with the AGV, wherein the wheels or the non-wheel arrangement is arranged at the second side of the thermal insulation base, wherein the cooperating alignment elements are configured to lift the wheels off a ground surface or lift the non-wheel arrangement off the AGV.

3. The burn-in apparatus of claim 2, further comprising:

a plurality of cooperating thermal insulation side elements respectively arranged at the frame and the chamber, and respectively having complementary characteristics configured to provide a clearance gap between the cooperating thermal insulation side

elements when the cooperating thermal insulation side elements partially overlap each other and further configured to provide an abutting fit between the cooperating thermal insulation side elements when the cooperating thermal insulation side elements substantially or fully overlap each other.

4. The burn-in apparatus of claim 3,

wherein the wheels of the frame include at least front wheels and rear wheels,

wherein the cooperating alignment elements include a plurality of rollers comprising at least front rollers and rear rollers, and further include at least one roller-receiving support, wherein the front rollers and the rear rollers are configured to respectively lift the front wheels and the rear wheels when the front rollers and the rear rollers are respectively coupled to the roller-receiving support,

wherein the cooperating alignment elements are arranged either

above the cooperating thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged inside the thermal zone, or

below the cooperating thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged outside the thermal zone.

5. The burn-in apparatus of claim 4, wherein

the rollers are arranged at the frame and the roller-receiving support is arranged at the chamber; or

the rollers are arranged at the chamber and the roller-receiving support is arranged at the frame.

6. The burn-in apparatus of any one of claim 3 to claim 5, wherein the cooperating alignment elements and/or the cooperating thermal insulation side elements are arranged proximal to or at the thermal insulation base of the frame and the base opening of the chamber.

7. A method comprising:

transferring a set of burn-in boards into a chamber by moving at least one frame into the chamber through a side opening thereof, wherein each frame includes a thermal

insulation base and a rack which is arranged at a first side of the thermal insulation base and supports the set of burn-in boards, wherein the chamber includes a set of receiving connectors arranged therein, wherein a plurality of cooperating alignment elements are respectively arranged at the frame and the chamber;

completing a thermal insulation of the chamber thereby defining a thermal zone configured to be subject to burn-in temperature provided by the chamber, including:

progressively and movably coupling the cooperating alignment elements to each other to lift the frame to bring the set of burn-in boards on the rack into alignment for insertion into the set of receiving connectors in the chamber and to close the base opening of the chamber by arranging at least the thermal insulation base of the frame in the base opening of the chamber, thereby removably docking the frame in the chamber,

inserting the set of burn-in boards into the set of receiving connectors in the chamber, and

closing the side opening such that the rack, the set of burn-in boards, and the first side of the thermal insulation base are in the thermal zone while a second side of the thermal insulation base is outside the thermal zone; and

performing burn-in process on semiconductor devices arranged in the set of burn-in boards.

8. The method of claim 7, wherein docking the at least one frame in the chamber includes:

arranging wheels which are manual or power assisted or are adapted to be used with an autonomous guided vehicle (AGV), or a non-wheel arrangement which is adapted to be used with the AGV, wherein the wheels or the non-wheel arrangement is arranged at the second side of the thermal insulation base, wherein docking the at least one frame in the chamber includes lifting the wheels of the frame off a ground surface or lifting the non-wheel arrangement of the frame off the AGV.

9. The method of claim 8, wherein progressively and movably coupling the cooperating alignment elements to each other includes:

progressively overlapping a plurality of cooperating thermal insulation side elements which are respectively arranged at the frame and the chamber;

providing, by complementary characteristics of the cooperating thermal insulation side elements, a clearance gap between the cooperating thermal insulation side

elements when the cooperating thermal insulation side elements partially overlap each other; and

providing, by the complementary characteristics of the cooperating thermal insulation side elements, an abutting fit between the cooperating thermal insulation side elements when the cooperating thermal insulation side elements substantially or fully overlap each other.

10. The method of claim 9, wherein the wheels of the frame include at least front wheels and rear wheels,

wherein the cooperating alignment elements include a plurality of rollers comprising at least front rollers and rear rollers, and further include at least one roller-receiving support,

wherein progressively and movably coupling the cooperating alignment elements to each other to lift the frame to bring the set of burn-in boards on the rack into alignment for insertion into the set of receiving connectors in the chamber includes respectively lifting the front wheels and the rear wheels when the front rollers and the rear rollers are respectively coupled to the roller-receiving support,

wherein the cooperating alignment elements are arranged either

above the cooperating thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged inside the thermal zone, or

below the cooperating thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged outside the thermal zone.

11. The method of claim 10, wherein

the rollers are arranged at the frame and the roller-receiving support is arranged at the chamber; or

the rollers are arranged at the chamber and the roller-receiving support is arranged at the frame.

12. A burn-in chamber comprising:

a chamber having at least one side opening, at least one base opening intersecting the side opening, a set of receiving connectors arranged in the chamber, and a first alignment element arranged at the chamber,

wherein at least the base opening, when unclosed, is configured to allow fluid communication between an interior of the chamber and an exterior of the chamber and to incomplete a thermal insulation of the chamber,

wherein the first alignment element is configured to be progressively and movably coupled to a cooperating second alignment element of at least one frame to lift the frame to bring a set of burn-in boards on the frame into alignment for insertion into the set of receiving connectors in the chamber and to close the base opening of the chamber by arranging a thermal insulation base of the frame in the base opening of the chamber, thereby removably docking the frame in the chamber,

wherein the thermal insulation of the chamber is configured to be completed when the side opening is closed and each frame is removably docked in the chamber to thereby define a thermal zone configured to be subject to burn-in condition provided by the chamber.

13. The burn-in chamber of claim 12, further comprising a first thermal insulation side element having a first characteristic which is complementary to a second characteristic of a second thermal insulation side element arranged at the frame, and configured to provide a clearance gap from the second thermal insulation side element when the first thermal insulation side element and the second thermal insulation side element partially overlap each other and to provide an abutting fit when the first thermal insulation side element and the second thermal insulation side element substantially or fully overlap each other.

14. The burn-in chamber of claim 13,

wherein the first and the second alignment elements include at least one roller-receiving support and a plurality of rollers comprising at least front rollers and rear rollers, wherein the front rollers and the rear rollers are configured to respectively lift front wheels and rear wheels of the frame when the front rollers and the rear rollers are respectively coupled to the roller-receiving support,

wherein the first and the second alignment elements are arranged either

above the first and the second thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged inside the thermal zone, or

below the first and the second thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged outside the thermal zone.

15. The burn-in chamber of claim 14, wherein the first alignment element includes at least one roller-receiving support or a plurality of rollers.

16. The burn-in chamber of any one of claim 13 to claim 15, wherein the first alignment element and/or the first thermal insulation side element are arranged proximal to or at the base opening.

17. A frame for transporting burn-in boards, the frame comprising:

a rack supporting a set of burn-in boards;

a thermal insulation base having a first side and a second side, wherein the rack is arranged at the first side of the thermal insulation base; and

a first alignment element configured to progressively couple to a cooperating second alignment element of a burn-in chamber to lift the frame to bring the set of burn-in boards on the rack into alignment for insertion into a set of receiving connectors arranged in the burn-in chamber and to close the base opening by arranging the thermal insulation base in the base opening of the chamber, thereby removably docking the frame in the chamber such that when a side opening of the burn-in chamber is closed, a thermal insulation of the burn-in chamber is completed to define a thermal zone configured to be subject to burn-in temperature of the chamber, and such that the rack, the burn-in boards, and the first side of the thermal insulation base are in the thermal zone while the second side of the thermal insulation base is outside the thermal zone.

18. The frame of claim 17, further comprising: wheels which are manual or power assisted or adapted to be used with an autonomous guided vehicle (AGV), or a non-wheel arrangement which is adapted to be used with the AGV, wherein the wheels or the non-wheel arrangement is arranged at the second side of the thermal insulation base, wherein when the frame is removably docked in the burn-in chamber, the first alignment element is configured to lift the wheels off a ground surface or lift the non-wheel arrangement off the AGV.

19. The frame of claim 18, further comprising a first thermal insulation side element having a first characteristic which is complementary to a second characteristic of a second thermal insulation side element arranged at the burn-in chamber, and configured to provide a clearance gap from the second thermal insulation side element when the first thermal insulation side element and the second thermal insulation side element partially overlap each other and further configured to provide an abutting fit when the first thermal insulation side element and the second thermal insulation side element substantially or fully overlap each other.

20. The frame of claim 19,

wherein the wheels include at least front wheels and rear wheels,

wherein the first and the second alignment elements include a plurality of rollers comprising at least front rollers and rear rollers, and further include at least one roller-receiving support, wherein the front rollers and the rear rollers are configured to respectively lift the front wheels and the rear wheels when the front rollers and the rear rollers are respectively coupled to the roller-receiving support,

wherein the first and the second alignment elements are arranged either

above the first and the second thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged inside the thermal zone, or

below the first and the second thermal insulation side elements such that when the side opening is closed and each frame is removably docked in the chamber, the cooperating alignment elements are arranged outside the thermal zone.

21. The frame of claim 20, wherein the first alignment element includes a plurality of rollers or at least one roller-receiving support.

22. The frame of any one of claim 19 to claim 21, wherein the first alignment element and/or the first thermal insulation side element are arranged proximal to or at the thermal insulation base.