

CLAIMS

1. A tester apparatus, comprising:

a portable supporting structure including first and second components for holding a substrate therebetween, the substrate carrying a microelectronic circuit and having a plurality of terminals connected to the microelectronic circuit, wherein the first component is a wafer chuck in the form of a planar piece having a planar face;

a plurality of contacts on the second component, the contacts matching the terminals for making contact to the terminals;

a cavity seal between the first and second components, the cavity seal forming an enclosed cavity together with surfaces of the first and second components;

a pressure reduction passage formed through one of the components, the pressure reduction passage having an inlet opening at the enclosed cavity and an outlet opening outside the enclosed cavity;

a pressure reduction supply connected to the pressure reduction passage, opening of the pressure reduction supply allowing gas out of the enclosed cavity and closing of the supply keeping gas from entering the enclosed cavity;

a first electrical interface on the portable supporting structure and connected to the contacts;

a portable structure gas removal interface on the portable structure;

a stationary structure, the portable supporting structure being receivable to be held by the stationary structure and being removable from the stationary structure;

a second electrical interface on the stationary structure, the second electrical

interface being connected to the first electrical interface when the portable structure is held by the stationary structure, and being disconnected from the first electrical interface when the portable supporting structure is removed from the stationary structure, wherein electrical tester is connected through the second electrical interface, the first electrical interface, and the contacts to the terminals.

a thermal chuck on the stationary structure, wherein the planar face of the wafer chuck is movable towards a planar face of the thermal chuck;

a gas removal conduit forming part of the stationary structure;

a stationary structure gas removal interface forming part of the stationary structure, the portable structure gas removal interface shaped to mate with the stationary structure gas removal interface when the wafer chuck moves towards the thermal chuck to connect the outlet opening of the pressure reduction passage to the gas removal conduit of the stationary structure; and

an electrical tester connected to the microelectronic circuit to test the microelectronic circuit.

2. The tester apparatus of claim 1, further comprising:

a gas supply passage formed through one of the components, the gas supply passage having an inlet opening outside the enclosed cavity and an outlet opening at the enclosed cavity; and

a gas inlet supply connected to the gas supply passage, opening of the gas inlet supply allowing gas into the enclosed cavity and into a space between the contacts.

3. The tester apparatus of claim 2, further comprising:
a source of dielectric gas connected to the gas supply passage.
4. The tester apparatus of claim 3, wherein the dielectric gas reduces arcing between the contacts compared to air.
5. The tester apparatus of claim 2, further comprising:
a vacuum pump connected to the a pressure reduction supply.
6. The tester apparatus of claim 2, further comprising:
an orifice connected to the gas supply passage to control flow of the dielectric gas through the gas supply passage.
7. The tester apparatus of claim 2, further comprising:
an orifice connected to the pressure reduction passage to control flow of the dielectric gas through the pressure reduction passage.
8. The tester apparatus of claim 2, further comprising:
a vacuum regulator connected to the pressure reduction passage to control flow of gas through the pressure reduction passage.
9. The tester apparatus of claim 8, further comprising:
a dielectric gas pressure regulator connected to the gas supply passage to control

flow of dielectric gas to the gas supply passage.

10. The tester apparatus of claim 9, further comprising:

a nitrogen gas pressure regulator connected to the gas supply passage to control flow of nitrogen gas to the gas supply passage.

11. The tester apparatus of claim 10, further comprising:

a channeling block connected to the dielectric gas pressure regulator and the nitrogen gas pressure regulator and connected to the gas supply passage to selectably provide the nitrogen gas or the dielectric gas to the gas supply passage.

12. The tester apparatus of claim 11, further comprising:

a gas supply connector for connection to the gas supply passage to provide the nitrogen gas or the dielectric gas to the gas supply passage.

13. The tester apparatus of claim 12, further comprising:

a vacuum supply connector for connection to the pressure reduction passage to provide the vacuum from the vacuum regulator to the pressure reduction passage.

14. The tester apparatus of claim 13, wherein the vacuum supply connector is connected through the channeling block to the vacuum regulator.

15. The tester apparatus of claim 13, further comprising:
- a vacuum receiving connector connectable to a vacuum pump to connect the vacuum regulator to the vacuum pump;
 - a nitrogen gas receiving connector connectable to a nitrogen gas inlet supply to connect the nitrogen gas inlet supply to the nitrogen gas pressure regulator; and
 - a dielectric gas receiving connector connectable to a dielectric gas inlet supply to connect the dielectric gas inlet supply to the dielectric gas pressure regulator.
16. The tester apparatus of claim 15, further comprising:
- a base, wherein the gas supply connector, vacuum supply connector, vacuum receiving connector, nitrogen gas receiving and dielectric gas receiving connector are mounted to the base.
17. The tester apparatus of claim 16, further comprising:
- an intermediate substrate, wherein the channeling block is mounted to the intermediate substrate, wherein the intermediate substrate is separable in a vertical direction from the base, wherein the base and the intermediate substrate have matching interfaces that releasably connect the gas supply connector, vacuum supply connector, vacuum receiving connector, nitrogen gas receiving and dielectric gas receiving connector to the channeling block.
18. The tester apparatus of claim 17, further comprising:
- a mounting plate secured to the intermediate substrate; and

a valve control connector secured to the mounting plate through which electrical signals can be provided to the vacuum regulator, nitrogen gas regulator and dielectric gas regulator.

19. The tester apparatus of claim 15, further comprising:

a transposition block to connect the vacuum receiving connector, nitrogen gas receiving and dielectric gas receiving connector to the channeling block and transpose flow of gasses from horizontally parallel in a first direction to vertically parallel in a second direction that is at right angles to the first direction.

20. The tester apparatus of claim 10, further comprising:

a control circuit to control the vacuum regulator, dielectric gas pressure regulator and nitrogen gas pressure regulator.

21. The tester apparatus of claim 1, wherein the first component is a wafer chuck in the form of a planar piece having a planar face that is movable towards a planar face of a thermal chuck of a stationary structure, further comprising:

a gas supply conduit forming part of the stationary structure;

a stationary structure gas supply interface forming part of the stationary structure;

and

a portable structure gas supply interface on the portable structure and shaped to mate with the stationary structure gas supply interface when the wafer chuck moves towards the thermal chuck to connect the inlet opening of the gas supply passage to the gas supply

conduit of the stationary structure.

22. The tester apparatus of claim 1, wherein opening of the pressure reduction supply to allow gas out of the enclosed cavity moves the first and second components relatively towards one another for ensuring proper contact between the contacts and the terminals.

23. The tester apparatus of claim 1, wherein the pressure reduction passage is formed in the first component.

24. The tester apparatus of claim 1, further comprising a latch system that includes:

- a first latch assembly having:

- a first part that engages with the first component;

- a second part that engages with the second component;

- a connecting part having opposing ends secured to the first and second parts respectively to form a locking arrangement; and

- an engaging mechanism connected to the locking arrangement and operable to move the locking arrangement between a locking position wherein the locking arrangement maintains the first and second components locked in the closed position and an unlocked position wherein the locking arrangement permits movement of the first and second components from the closed relationship into the spaced relationship.

25. The tester apparatus of claim 1, further comprising a pressure monitoring system that includes:

a pressure sensor positioned to detect a pressure in the enclosed cavity; and
an electrical pressure sensor interface connected to the pressure sensor to
communicate the pressure with an electric tester.

26. A wafer pack, comprising:

a portable supporting structure including first and second components for holding a
substrate therebetween, the substrate carrying a microelectronic circuit and having a
plurality of terminals connected to the microelectronic circuit, wherein the first component
is a wafer chuck in the form of a planar piece having a planar face that is movable towards a
planar face of a thermal chuck of a stationary structure;

a plurality of contacts on the second component, the contacts matching the terminals
for making contact to the terminals;

a cavity seal between the first and second components, the cavity seal forming an
enclosed cavity together with surfaces of the first and second components;

a pressure reduction passage formed through one of the components, the pressure
reduction passage having an inlet opening at the enclosed cavity and an outlet opening
outside the enclosed cavity;

a pressure reduction supply connected to the pressure reduction passage, opening of
the pressure reduction supply allowing gas out of the enclosed cavity and closing of the
supply keeping gas from entering the enclosed cavity;

a first electrical interface, on the portable supporting structure and connected to the
contacts, for connection to a second electrical interface on a stationary structure when the
portable supporting structure is removably held by the stationary structure; and

a portable structure gas removal interface shaped to mate with a stationary structure gas removal interface when the wafer chuck moves towards the thermal chuck to connect the outlet opening of the pressure reduction passage to a gas removal conduit of the stationary structure.

27. The wafer pack of claim 26, further comprising:

a gas supply passage formed through one of the components, the gas supply passage having an inlet opening outside the enclosed cavity and an outlet opening at the enclosed cavity; and

a gas inlet supply connected to the gas supply passage, opening of the gas inlet supply allowing gas into the enclosed cavity and into a space between the contacts.

28. The wafer pack of claim 27, wherein the first component is a wafer chuck in the form of a planar piece having a planar face that is movable towards a planar face of a thermal chuck of a stationary structure, further comprising:

a portable structure gas supply interface shaped to mate with a stationary structure gas supply interface when the wafer chuck moves towards the thermal chuck to connect the inlet opening of the gas supply passage to a gas supply conduit of the stationary structure.

29. The wafer pack of claim 26, wherein opening of the pressure reduction supply to allow gas out of the enclosed cavity moves the first and second components relatively towards one another for ensuring proper contact between the contacts and the terminals.

30. The wafer pack of claim 26, wherein the pressure reduction passage is formed in the first component.

31. The wafer pack of claim 26, further comprising a latch system that includes:

a first latch assembly having:

a first part that engages with the first component;

a second part that engages with the second component;

a connecting part having opposing ends secured to the first and second parts

respectively to form a locking arrangement; and

an engaging mechanism connected to the locking arrangement and operable to move the locking arrangement between a locking position wherein the locking arrangement maintains the first and second components locked in the closed position and an unlocked position wherein the locking arrangement permits movement of the first and second components from the closed relationship into the spaced relationship.

32. The wafer pack of claim 26, further comprising a pressure monitoring system that includes:

a pressure sensor positioned to detect a pressure in the enclosed cavity; and

an electrical pressure sensor interface connected to the pressure sensor to

communicate the pressure with an electric tester.

33. A method of testing a microelectronic circuit held by a substrate, comprising:

holding the substrate between first and second components, the second component

having contacts against terminals of the substrate connected to the microelectronic circuit wherein the first component is a wafer chuck in the form of a planar piece having a planar face;

locating a cavity seal between the first and second components to form an enclosed cavity by surfaces of the first and second components and the cavity seal;

receiving the portable supporting structure by a stationary structure with a first electrical interface on the portable supporting structure connected to a second electrical interface on the stationary structure;

moving the planar face of the wafer chuck towards a planar face of a thermal chuck of a stationary structure to further mate a portable structure gas removal interface with a stationary structure gas removal interface to connect the outlet opening of the pressure reduction passage to a gas removal conduit of the stationary structure; and

transmitting signals between an electrical tester and the microelectronic circuit to test the microelectronic circuit, wherein the signals are transmitted between the electrical tester and the microelectronic circuit through the terminals, contacts, and first and second electrical interfaces to test the microelectronic circuit.

34. The method of claim 33, further comprising:

allowing a dielectric gas into the enclosed cavity into a space between the contacts.

35. The method of claim 34, wherein a pressure reduction passage is formed through one of the components, the pressure reduction passage having an inlet opening at the enclosed cavity and an outlet opening outside the enclosed cavity, further comprising:

opening a gas inlet supply to allow a dielectric gas through a gas supply passage formed through one of the components into the enclosed cavity into space between the contacts.

36. The method of claim 33, wherein the dielectric gas reduces arcing between the contacts compared to air.

37. The method of claim 35, further comprising:
controlling flow of the dielectric gas through the gas supply passage by passing the dielectric gas through an orifice.

38. The method of claim 35, further comprising:
controlling flow of the dielectric gas through the pressure reduction passage by passing the dielectric gas through an orifice.

39. The method of claim 35, wherein the first and second components form part of a portable supporting structure, further comprising:
receiving the portable supporting structure by a stationary structure with a first electrical interface on the portable supporting structure connected to a second electrical interface on the stationary structure, wherein the signals are transmitted between the electrical tester and the microelectronic circuit through the terminals, contacts, and first and second electrical interfaces to test the microelectronic circuit.

40. The method of claim 35, further comprising:
using a vacuum regulator connected to the pressure reduction passage to control flow of gas through the pressure reduction passage.
41. The method of claim 35, further comprising:
using a dielectric gas pressure regulator connected to the gas supply passage to control flow of dielectric gas to the gas supply passage.
42. The method of claim 35, further comprising:
a nitrogen gas pressure regulator connected to the gas supply passage to control flow of nitrogen gas to the gas supply passage.
43. The method of claim 42, further comprising:
using a control circuit to control the vacuum regulator, dielectric gas pressure regulator and nitrogen gas pressure regulator.
44. The method of claim 39, wherein the first component is a wafer chuck in the form of a planar piece having a planar face, further comprising:
moving the planar face of the wafer chuck towards a planar face of a thermal chuck of a stationary structure to further mate a portable structure gas supply interface with a stationary structure gas supply interface to connect the inlet opening of the gas supply passage to a gas supply conduit of the stationary structure.

45. The method of claim 33, wherein opening of the pressure reduction supply to allow gas out of the enclosed cavity moves the first and second components relatively towards one another for ensuring proper contact between the contacts and the terminals.

46. The method of claim 33, wherein the pressure reduction passage is formed in the first component.

47. The method of claim 33, further comprising:

operating an engaging mechanism to move the locking arrangement between a locking position wherein the locking arrangement maintains the first and second components locked in the closed position and an unlocked position wherein the locking arrangement permits movement of the first and second components from the closed relationship into the spaced relationship, the locking arrangement including:

a first part that engages with the first component;

a second part that engages with the second component; and

a connecting part having opposing ends secured to the first and second parts,

respectively.

48. The method of claim 33, further comprising:

detecting a pressure in the enclosed cavity; and

communicating the pressure with the electric tester.