

CLAIMS

1. A semiconductor wafer processing method comprising:
controlling the temperature of a semiconductor wafer to be within a predetermined processing temperature range by:
causing a first change in the temperature of the semiconductor wafer using a first temperature changing unit;
and
subsequently causing a second change in the temperature of the semiconductor wafer using a second temperature changing unit;
wherein the magnitude of the first change is greater than the magnitude of the second change; and
subsequently loading the semiconductor wafer on to a processing area of a semiconductor wafer processing apparatus.
2. The method according to claim 1, wherein the magnitude of the first temperature change comprises at least 80%, or at least 90%, or at least 95% of the sum of the magnitudes of the first and second temperature changes.
3. The method according to claim 1 or claim 2, wherein causing the first change in the temperature of the semiconductor wafer comprises changing the temperature of the semiconductor wafer to be within $\pm 3^{\circ}\text{C}$, or within $\pm 2^{\circ}\text{C}$, or within $\pm 1^{\circ}\text{C}$ of a predetermined processing temperature.
4. The method according to any one of the previous claims, wherein causing the second change in the temperature of the semiconductor wafer comprises substantially equalising the temperature of the semiconductor wafer to a predetermined processing temperature.
5. The method according to claim 3 or claim 4, wherein the predetermined processing temperature is a temperature of

the processing area of the semiconductor wafer processing apparatus.

6. The method according to any one of the previous claims, wherein causing the second change in the temperature of the semiconductor wafer comprises changing the temperature of the semiconductor wafer by less than 3°C, or less than 2°C, or less than 1°C.

7. The method according to any one of the previous claims, wherein:

the method is a semiconductor wafer metrology method;
the temperature of the semiconductor wafer is controlled to be within a predetermined measurement temperature range;
and

the semiconductor wafer is loaded on to a measurement area of a semiconductor wafer metrology apparatus.

8. The method according to any one of the previous claims, wherein:

the first temperature changing unit comprises a first cooling unit; and

causing the first change in the temperature of the semiconductor wafer comprises cooling the semiconductor wafer using the first cooling unit.

9. The method according to claim 8, wherein the first cooling unit actively dissipates heat removed from the semiconductor wafer.

10. The method according to any one of the previous claims, wherein the first temperature changing unit comprises a first thermal transfer plate.

11. The method according to any one of the previous claims, wherein:

the second temperature changing unit comprises a second cooling unit; and

causing the second change in the temperature of the semiconductor wafer comprises cooling the semiconductor wafer using the second cooling unit.

12. The method according to claim 11, wherein the second cooling unit actively dissipates heat removed from the semiconductor wafer.

13. The method according to any one of the previous claims, wherein the second temperature changing unit comprises a second thermal transfer plate.

14. The method according to claim 13, wherein the second thermal transfer plate has substantially the same temperature as the processing area of the semiconductor wafer processing apparatus.

15. The method according to claim 13 or claim 14, wherein the second thermal transfer plate is thermally coupled to, or integral to, the processing area of the semiconductor wafer processing apparatus.

16. The method according to any one of the previous claims, wherein:

the semiconductor wafer processing apparatus comprises a weighing apparatus; and

the method comprises determining information relating to the mass of the semiconductor wafer.

17. The method according to any one of the previous claims, wherein the method comprises:

transporting the semiconductor wafer from the second temperature changing unit to the processing area of the semiconductor wafer processing apparatus; and

controlling the temperature of the semiconductor wafer during the transporting step.

18. A semiconductor wafer processing method comprising: controlling the temperature of a semiconductor wafer to be within a predetermined processing temperature range by causing a change in the temperature of the semiconductor wafer using a temperature changing unit;

transporting the semiconductor wafer from the temperature changing unit to a processing area of a semiconductor wafer processing apparatus; and

controlling the temperature of the semiconductor wafer during the transporting step.

19. The method according to claim 18, wherein the temperature changing unit comprises a thermal transfer plate.

20. The method according to claim 18 or claim 19, wherein:

the method comprises a semiconductor wafer metrology method; and

the semiconductor wafer is transported from the temperature changing unit to a measurement area of a semiconductor wafer metrology apparatus.

21. The method according to any one of claims 17 to 20, wherein the method comprises controlling the temperature of a semiconductor wafer transporter used to transport the semiconductor wafer.

22. The method according to any one of claims 17 to 21, wherein the method comprises controlling the temperature of a

volume of air through which the semiconductor wafer is transported.

23. The method according to claim 21 or claim 22, wherein the temperature is controlled to be substantially the same as the temperature of the processing area of the semiconductor wafer processing apparatus.

24. A semiconductor wafer processing apparatus comprising:

a first temperature changing unit for causing a first change in the temperature of a semiconductor wafer;

a second temperature changing unit for subsequently causing a second change in the temperature of the semiconductor wafer; and

a processing area.

25. The apparatus according to claim 24, wherein: the apparatus comprises a semiconductor wafer metrology apparatus; and

the processing area comprises a measurement area.

26. The apparatus according to claim 24 or claim 25, wherein the first temperature changing unit comprises a first cooling unit for cooling the semiconductor wafer.

27. The apparatus according to claim 26, wherein the first cooling unit is arranged to actively dissipate heat removed from the semiconductor wafer.

28. The apparatus according to any one of claims 24 to 27, wherein the first temperature changing unit comprises a first thermal transfer plate.

29. The apparatus according to any one of claims 24 to 28, wherein the second temperature changing unit comprises a second cooling unit for cooling the semiconductor wafer.

30. The apparatus according to claim 29, wherein the second cooling unit is arranged to actively dissipate heat removed from the semiconductor wafer.

31. The apparatus according to any one of claims 24 to 30, wherein the second temperature changing unit comprises a second thermal transfer plate.

32. The apparatus according to any one of claims 24 to 31, wherein the second thermal transfer plate is at substantially the same temperature as the processing area of the semiconductor wafer processing apparatus.

33. The apparatus according to any one of claims 24 to 32, wherein the second thermal transfer plate is thermally coupled to, or integral to, the processing area of the semiconductor wafer processing apparatus.

34. The apparatus according to any one of claims 24 to 33, wherein the apparatus comprises a weighing apparatus.

35. The apparatus according to any one of claims 24 to 34, wherein the apparatus comprises:

a semiconductor wafer transporter for transporting the semiconductor wafer from the second temperature changing unit to the processing area of the semiconductor wafer processing apparatus; and

temperature control means for controlling the temperature of the semiconductor wafer during the transporting.

36. A semiconductor wafer processing apparatus comprising:

a temperature changing unit for causing a change in the temperature of a semiconductor wafer;

a semiconductor wafer transporter for transporting the semiconductor wafer from the temperature changing unit to a processing area of a semiconductor wafer processing apparatus; and

temperature control means for controlling the temperature of the semiconductor wafer during the transporting.

37. The apparatus according to claim 36, wherein the temperature changing unit comprises a thermal transfer plate.

38. The apparatus according to claim 36 or claim 37, wherein:

the apparatus comprises a semiconductor wafer metrology apparatus; and

the semiconductor wafer transporter is for transporting the semiconductor wafer from the temperature changing unit to a measurement area of the semiconductor wafer metrology apparatus.

39. The apparatus according to any one of claims 35 to 38, wherein the apparatus comprises a further temperature changing unit arranged to change the temperature of the semiconductor wafer transporter.

40. The apparatus according to any one of claims 35 to 39, wherein the apparatus comprises a further temperature changing unit arranged to change the temperature of a volume of air through which the semiconductor wafer is transported.

41. The apparatus according to claim 39 or claim 40, wherein the further temperature changing unit comprises a heater.

42. The apparatus according to any one of claims 39 to 41, wherein the apparatus comprises:

a temperature sensor; and

a controller arranged to control the further temperature changing unit based on an output of the temperature sensor.

43. The apparatus according to claim 40, wherein the apparatus comprises a fan arranged to blow air across the further temperature changing unit to change the temperature of the volume of air through which the semiconductor wafer is transported.

44. The apparatus according to claim 43, wherein the apparatus comprises:

a temperature sensor; and

a controller arranged to control the fan based on an output of the temperature sensor.

45. The apparatus according to any one of claims 35 to 44, wherein the semiconductor wafer transporter comprises a robotic arm.

CLAIMS

1. A semiconductor wafer processing method comprising:
controlling the temperature of a semiconductor wafer to
5 be within a predetermined processing temperature range by:
causing a first change in the temperature of the
semiconductor wafer using a first temperature changing unit;
and
subsequently causing a second change in the
10 temperature of the semiconductor wafer using a second
temperature changing unit, wherein the second temperature
changing unit comprises a thermal transfer plate that is
thermally coupled to, or integral to, the processing area of
the semiconductor wafer processing apparatus, so that the
15 thermal transfer plate has substantially the same temperature
as the processing area of the semiconductor wafer processing
apparatus;
wherein the magnitude of the first change is greater than
the magnitude of the second change; and
20 subsequently loading the semiconductor wafer on to a
processing area of a semiconductor wafer processing apparatus.
2. The method according to claim 1, wherein the
magnitude of the first temperature change comprises at least
25 80%, or at least 90%, or at least 95% of the sum of the
magnitudes of the first and second temperature changes.
3. The method according to claim 1 or claim 2, wherein
causing the first change in the temperature of the
30 semiconductor wafer comprises changing the temperature of the
semiconductor wafer to be within $\pm 3^{\circ}\text{C}$, or within $\pm 2^{\circ}\text{C}$, or
within $\pm 1^{\circ}\text{C}$ of a predetermined processing temperature.
4. The method according to any one of the previous
35 claims, wherein causing the second change in the temperature
of the semiconductor wafer comprises changing the temperature

of the semiconductor wafer by less than 3°C, or less than 2°C, or less than 1°C.

5 5. The method according to any one of the previous
claims, wherein:
 the method is a semiconductor wafer metrology method;
 the temperature of the semiconductor wafer is controlled
to be within a predetermined measurement temperature range;
and
10 the semiconductor wafer is loaded on to a measurement
area of a semiconductor wafer metrology apparatus.

 6. The method according to any one of the previous
claims, wherein:
15 the first temperature changing unit comprises a first
cooling unit;
 causing the first change in the temperature of the
semiconductor wafer comprises cooling the semiconductor wafer
using the first cooling unit;
20 the second temperature changing unit comprises a second
cooling unit; and
 causing the second change in the temperature of the
semiconductor wafer comprises cooling the semiconductor wafer
using the second cooling unit.

25 7. The method according to any one of the previous
claims, wherein:
 the semiconductor wafer processing apparatus comprises a
weighing apparatus; and
30 the method comprises determining information relating to
the mass of the semiconductor wafer.

 8. The method according to any one of the previous
claims, wherein the method comprises:
35 transporting the semiconductor wafer from the second

temperature changing unit to the processing area of the semiconductor wafer processing apparatus; and

controlling the temperature of the semiconductor wafer during the transporting step.

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9. A semiconductor wafer processing method comprising:

controlling the temperature of a semiconductor wafer to be within a predetermined processing temperature range by causing a change in the temperature of the semiconductor wafer using a temperature changing unit;

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transporting the semiconductor wafer from the temperature changing unit to a processing area of a semiconductor wafer processing apparatus; and

controlling the temperature of the semiconductor wafer during the transporting step.

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10. The method according to claim 9, wherein:

the method comprises a semiconductor wafer metrology method; and

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the semiconductor wafer is transported from the temperature changing unit to a measurement area of a semiconductor wafer metrology apparatus.

11. The method according to any one of claims 8 to 10, wherein the method comprises controlling the temperature of a semiconductor wafer transporter used to transport the semiconductor wafer.

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12. The method according to any one of claims 8 to 11, wherein the method comprises controlling the temperature of a volume of air through which the semiconductor wafer is transported.

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13. The method according to claim 11 or claim 12, wherein the temperature is controlled to be substantially the

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same as the temperature of the processing area of the semiconductor wafer processing apparatus.

14. A semiconductor wafer processing apparatus
5 comprising:

a processing area;

a first temperature changing unit for causing a first change in the temperature of a semiconductor wafer; and

a second temperature changing unit for subsequently
10 causing a second change in the temperature of the semiconductor wafer, wherein the second temperature changing unit comprises a thermal transfer plate that is thermally coupled to, or integral to, the processing area, so that the thermal transfer plate has substantially the same temperature
15 as the processing area.

15. The apparatus according to claim 14, wherein:

the apparatus comprises a semiconductor wafer metrology apparatus; and

20 the processing area comprises a measurement area.

16. The apparatus according to claim 14 or claim 15, wherein the first temperature changing unit comprises a first cooling unit for cooling the semiconductor wafer; and

25 the second temperature changing unit comprises a second cooling unit for cooling the semiconductor wafer.

17. The apparatus according to any one of claims 14 to 16, wherein the apparatus comprises a weighing apparatus.

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18. The apparatus according to any one of claims 14 to 17, wherein the apparatus comprises:

a semiconductor wafer transporter for transporting the semiconductor wafer from the second temperature changing unit
35 to the processing area of the semiconductor wafer processing

apparatus; and

temperature control means for controlling the temperature of the semiconductor wafer during the transporting.

5 19. A semiconductor wafer processing apparatus comprising:

a temperature changing unit for causing a change in the temperature of a semiconductor wafer;

10 a semiconductor wafer transporter for transporting the semiconductor wafer from the temperature changing unit to a processing area of a semiconductor wafer processing apparatus; and

temperature control means for controlling the temperature of the semiconductor wafer during the transporting.

15 20. The apparatus according to claim 19, wherein:

the apparatus comprises a semiconductor wafer metrology apparatus; and

20 the semiconductor wafer transporter is for transporting the semiconductor wafer from the temperature changing unit to a measurement area of the semiconductor wafer metrology apparatus.

25 21. The apparatus according to any one of claims 18 to 20, wherein the apparatus comprises a first further temperature changing unit arranged to change the temperature of the semiconductor wafer transporter.

30 22. The apparatus according to any one of claims 18 to 21, wherein the apparatus comprises a second further temperature changing unit arranged to change the temperature of a volume of air through which the semiconductor wafer is transported.

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23. The apparatus according to claim 21 or claim 22,
wherein the apparatus comprises:

a temperature sensor; and

5 a controller arranged to control the further temperature
changing unit based on an output of the temperature sensor.

24. The apparatus according to claim 22, wherein the
apparatus comprises a fan arranged to blow air across the
second further temperature changing unit to change the
10 temperature of the volume of air through which the
semiconductor wafer is transported.

25. The apparatus according to claim 24, wherein the
apparatus comprises:

15 a temperature sensor; and

a controller arranged to control the fan based on an
output of the temperature sensor.