CLAIMS

1. A support table, for a lithographic apparatus, configured to support a substrate, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof; and

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section and each of the conditioning regions configured such that it corresponds to a section of the upper face of the support section having an area within a range of from approximately 50% to approximately 350% of the area of the substrate in contact with an immersion fluid provided by a fluid handling structure and having an aspect ratio of between 1 and approximately 2.

2. The support table according to claim 1, wherein each of the conditioning units comprises an electric heater.

3. The support table according to claim 1 or claim 2, wherein each of the conditioning units comprises a channel within the corresponding conditioning region, the channel configured to convey a conditioning fluid and connected to an inlet to provide the conditioning fluid and an outlet for exhausting the conditioning fluid.

4. The support table according to any of claims 1 to 3, wherein the conditioning system further comprises a global conditioning unit, configured to supply heat energy to and/or remove heat energy from all of the conditioning regions.

5. The support table according to claim 4, wherein the global conditioning unit comprises a channel, configured to convey a conditioning fluid to pass through each of the conditioning regions and is connected to an associated inlet to provide the conditioning fluid and outlet for exhausting the conditioning fluid.

6. The support table according to any of the preceding claims, further comprising a plurality of temperature sensors, each sensor configured to measure the temperature of the support table at a respective location; and

a controller, configured to control the conditioning system, the controller configured to control the conditioning system based on the measurement data from the temperature sensors.

7. A support table, for a lithographic apparatus, configured to support a substrate, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof;

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section;

a plurality of temperature sensors, configured to measure the temperature of the support table at a respective location; and

a controller, configured to control the conditioning system based on the measurement data from the temperature sensors.

8. The support table according to claim 6 or claim 7, wherein at least one temperature sensor is provided to each conditioning region and/or wherein a plurality of temperature sensors are provided to each conditioning region.

9. The support table according to any of claims 6 to 8, wherein the controller comprises a memory, configured to store calibration data for each of the temperature sensors.

10. The support table according to claim 9, wherein the controller is configured to generate or receive revised calibration data based on a calibration test, in which a temperature sensor provides measurement data when the temperature sensor is at a known temperature and/or wherein the controller is configured to store calibration correction data for each temperature sensor; and the controller is configured to control the conditioning system based on measurement data from the temperature sensors, the corresponding calibration data and the corresponding calibration correction data.

11. The support table according to claim 10, wherein the controller is configured to generate the calibration correction data by performing a calibration correction data generation process comprising:

substantially simultaneously obtaining measurement data from a plurality of the temperature sensors;

determining temperature data for each temperature sensor based on the measurement data and the calibration data for each temperature sensor;

determining for each temperature sensor a deviation of its temperature data from the mean temperature data for the plurality of temperature sensors; and

storing calibration correction data for each temperature sensor that corresponds to the determined deviation.

12. The support table according to claim 11, wherein the calibration correction data generation process is performed using measurement data from all of the temperature sensors within a conditioning region of the support section or wherein the calibration correction data generation process is performed using measurement data from all of the temperature sensors within the support section.

13. The support table according to claim 11 or 12, wherein the calibration correction data generation process is performed when a fluid handling structure is not providing immersion fluid to an area on an upper surface of a substrate supported by the support table.

14. The support table according to any of claims 11 to 13, wherein the calibration data generation process is performed when the support table is at a location in a lithographic apparatus at which at least one of the following occurs: the substrate is unloaded from the support table; the substrate is loaded to the support table; and/or the substrate supported by the support table is inspected by a measurement system.

15. The support table according to any of the preceding claims, wherein the support table is configured to support the substrate in a recess, and

further comprising an extraction system, configured to extract immersion fluid from a gap between the edge of the recess and the edge of the substrate, the extraction system comprising a plurality of independently controllable extraction units, each extraction unit configured to extract immersion fluid from a respective segment of the gap.

16. The support table according to any of the preceding claims, further comprising a second conditioning system, configured to supply heat energy to and/or remove heat

energy from a region of the support table adjacent a gap between the edge of a recess and the edge of the substrate, the second conditioning system comprising a plurality of independently controllable conditioning units, each configured to supply heat energy to and/or remove heat energy from a respective region of the support table adjacent a respective segment of the gap.

17. The support table according to any of the preceding claims, wherein the support section comprises a plurality of support table sections mechanically connected to each other by a connector, each of the support table sections corresponding to a respective conditioning region.

18. A support table, for a lithographic apparatus, configured to support a substrate, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof; and

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section,

wherein each of the conditioning units comprises a channel within the corresponding conditioning region, the channel configured to convey a conditioning fluid.

19. A support table, for a lithographic apparatus, configured to support a substrate in a recess, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof;

a first conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the first conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section; and

a second conditioning system, configured to supply heat energy to and/or remove heat energy from a region of the support table adjacent a gap between the edge of the recess and the edge of the substrate, the second conditioning system comprising a plurality of independently controllable conditioning units, each configured to supply heat energy to and/or remove heat energy from a respective region of the support table adjacent a respective segment of the gap.

20. A support table, for a lithographic apparatus, configured to support a substrate in a recess, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof;

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section; and

an extraction system, configured to extract immersion liquid from a gap between the edge of the recess and the edge of the substrate, the extraction system comprising a plurality of independently controllable extraction units, each configured to extract immersion liquid from a respective segment of the gap.

21. A support table, for a lithographic apparatus, configured to support a substrate, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof, the support section comprising a plurality of support table sections mechanically connected to each other by a connector, each of the support table sections corresponding to a respective conditioning region; and

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from its respective conditioning region of the support section.

22. A lithographic apparatus, comprising a support table according to any of the preceding claims.

23. A device manufacturing method comprising:

projecting a patterned beam of radiation through an immersion liquid provided by a fluid handling structure to a space between a projection system and a substrate supported on an upper surface of a support section of a support table;

using a conditioning system to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units, each configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section, each of the conditioning regions corresponding to a section of the upper face of the support section having an area within a range of from approximately 50% to approximately 350% of the area of the substrate in contact with immersion fluid provided by the fluid handling structure and having an aspect ratio of between 1 and approximately 2; and

controlling each of the conditioning units independently.

24. A device manufacturing method comprising:

projecting a patterned beam of radiation through an immersion liquid to a space between a projection system and a substrate supported on a support section of a support table;

using a conditioning system to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each conditioning unit configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section; and

controlling the conditioning system based on measurement data from a plurality of temperature sensors, each configured to measure the temperature of the support table at a respective location.

25. A method of generating calibration correction data for a plurality of temperature sensors, each configured to measure the temperature of a support table in a lithographic apparatus, the method comprising:

substantially simultaneously obtaining measurement data from the temperature sensors;

determining temperature data for each temperature sensor based on the measurement data and existing calibration data for each temperature sensor;

determining for each temperature sensor a deviation of its temperature data from the mean temperature data for the plurality of temperature sensors; and

determining calibration correction data for each temperature sensor that corresponds to the determined deviation.

CLAIMS

1. A support table, for a lithographic apparatus, configured to support a substrate, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof; and

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section and each of the conditioning regions configured such that it corresponds to a section of the upper face of the support section having an area within a range of from approximately 50% to approximately 350% of the area of the substrate in contact with an immersion fluid provided by a fluid handling structure and having an aspect ratio of between 1 and approximately 2.

2. The support table according to claim 1, wherein each of the conditioning units comprises an electric heater.

3. The support table according to claim 1 or claim 2, wherein each of the conditioning units comprises a channel within the corresponding conditioning region, the channel configured to convey a conditioning fluid and connected to an inlet to provide the conditioning fluid and an outlet for exhausting the conditioning fluid.

4. The support table according to any of claims 1 to 3, wherein the conditioning system further comprises a global conditioning unit, configured to supply heat energy to and/or remove heat energy from all of the conditioning regions.

5. The support table according to claim 4, wherein the global conditioning unit comprises a channel, configured to convey a conditioning fluid to pass through each of the conditioning regions and is connected to an associated inlet to provide the conditioning fluid and outlet for exhausting the conditioning fluid.

6. The support table according to any of the preceding claims, further comprising a plurality of temperature sensors, each sensor configured to measure the temperature of the support table at a respective location; and

controller, configured to control the conditioning system, the controller configured to control the conditioning system based on the measurement data from the temperature sensors.

7. The support table according to claim 6, wherein at least one temperature sensor is provided to each conditioning region and/or wherein a plurality of temperature sensors are provided to each conditioning region.

8. The support table according to claim 6 or 7, wherein the controller comprises a memory, configured to store calibration data for each of the temperature sensors.

9. The support table according to claim 8, wherein the controller is configured to generate or receive revised calibration data based on a calibration test, in which a temperature sensor provides measurement data when the temperature sensor is at a known temperature and/or wherein the controller is configured to store calibration correction data for each temperature sensor; and the controller is configured to control the conditioning system based on measurement data from the temperature sensors, the corresponding calibration data and the corresponding calibration correction data.

10. The support table according to the preceding claim, wherein the controller is configured to generate the calibration correction data by performing a calibration correction data generation process comprising:

substantially simultaneously obtaining measurement data from a plurality of the temperature sensors;

determining temperature data for each temperature sensor based on the measurement data and the calibration data for each temperature sensor;

determining for each temperature sensor a deviation of its temperature data from the mean temperature data for the plurality of temperature sensors; and

storing calibration correction data for each temperature sensor that corresponds to the determined deviation.

11. The support table according to the preceding claim, wherein the calibration correction data generation process is performed using measurement data from all of the temperature sensors within a conditioning region of the support section or wherein the calibration correction data generation process is performed using measurement data from all of the temperature sensors within the support section.

12. The support table according to claim 10 or 11, wherein the calibration correction data generation process is performed when a fluid handling structure is not providing immersion fluid to an area on an upper surface of a substrate supported by the support table.

13. The support table according to any of claims 10 to 12, wherein the calibration data generation process is performed when the support table is at a location in a lithographic apparatus at which at least one of the following occurs: the substrate is unloaded from the support table; the substrate is loaded to the support table; and/or the substrate supported by the support table is inspected by a measurement system.

14. The support table according to any of the preceding claims, wherein the support table is configured to support the substrate in a recess, and

further comprising an extraction system, configured to extract immersion fluid from a gap between the edge of the recess and the edge of the substrate, the extraction system comprising a plurality of independently controllable extraction units, each extraction unit configured to extract immersion fluid from a respective segment of the gap.

15. The support table according to any of the preceding claims, further comprising a second conditioning system, configured to supply heat energy to and/or remove heat energy from a region of the support table adjacent a gap between the edge of a recess and the edge of the substrate, the second conditioning system comprising a plurality of independently controllable conditioning units, each configured to supply heat energy to and/or remove heat energy from a respective region of the support table adjacent a respective segment of the gap.

16. The support table according to any of the preceding claims, wherein the support section comprises a plurality of support table sections mechanically connected to each other by a connector, each of the support table sections corresponding to a respective conditioning region.

17. The support table according to any of the preceding claims, wherein one of the conditioning regions is arranged at the center of the support section and the other conditioning regions are arranged to surround the one of the conditioning regions.

18. A support table, for a lithographic apparatus, configured to support a substrate in a recess, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof;

a first conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the first conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section; and

a second conditioning system, configured to supply heat energy to and/or remove heat energy from a region of the support table adjacent a gap between the edge of the recess and the edge of the substrate, the second conditioning system comprising a plurality of independently controllable conditioning units, each configured to supply heat energy to and/or remove heat energy from a respective region of the support table adjacent a respective segment of the gap,

19. The support table of claim 18, wherein each of the conditioning units comprises a channel within the corresponding conditioning region, the channel configured to convey a conditioning fluid.

20. A support table, for a lithographic apparatus, configured to support a substrate in a recess, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof;

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section; and

an extraction system, configured to extract immersion liquid from a gap between the edge of the recess and the edge of the substrate, the extraction system comprising a plurality of independently controllable extraction units, each configured to extract immersion liquid from a respective segment of the gap.

21. A support table, for a lithographic apparatus, configured to support a substrate, the support table comprising:

a support section, configured to support a lower surface of a substrate on an upper face thereof;

the support section comprising a plurality of support table sections mechanically connected to each other by a connector, each of the support table sections corresponding to a respective conditioning region; and

a conditioning system, configured to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each of the conditioning units configured to supply heat energy to and/or remove heat energy from its respective conditioning region of the support section.

22. A device manufacturing method comprising:

projecting a patterned beam of radiation through an immersion liquid provided by a fluid handling structure to a space between a projection system and a substrate supported on an upper surface of a support section of a support table;

using a conditioning system to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units, each configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section, each of the conditioning regions corresponding to a section of the upper face of the support section having an area within a range of from approximately 50% to approximately 350% of the area of the substrate in contact with immersion fluid provided by the fluid handling structure and having an aspect ratio of between 1 and approximately 2; and

controlling each of the conditioning units independently.

23. A device manufacturing method comprising:

projecting a patterned beam of radiation through an immersion liquid to a space between a projection system and a substrate supported on a support section of a support table;

using a conditioning system to supply heat energy to and/or remove heat energy from the support section, the conditioning system comprising a plurality of conditioning units that are independently controllable, each conditioning unit configured to supply heat energy to and/or remove heat energy from a respective conditioning region of the support section;

using a controller to control the conditioning system based on, measurement data from a plurality of temperature sensors and calibration correction data generated for the

plurality of temperature sensors, each sensor configured to measure the temperature of the support table at a respective location.

24. A method of generating calibration correction data for a plurality of temperature sensors, each configured to measure the temperature of a support table in a lithographic apparatus, the method comprising:

substantially simultaneously obtaining measurement data from the temperature sensors;

determining temperature data for each temperature sensor based on the measurement data and existing calibration data for each temperature sensor;

determining for each temperature sensor a deviation of its temperature data from the mean temperature data for the plurality of temperature sensors; and

determining calibration correction data for each temperature sensor that corresponds to the determined deviation.