CLAIMS

1. A lithographic apparatus arranged to project a pattern from a patterning device onto a substrate, the lithographic apparatus comprising:

at least one housing comprising at least one internal wall;

at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall and configured to receive a radiation beam;

a cooling apparatus arranged to cool at least a portion of the at least one internal wall to a temperature below that of the at least one optical component such that during use of the cooling apparatus at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component;

wherein the cooling apparatus is arranged to provide a difference in temperature between the at least a portion of the at least one internal wall and the at least one optical component of at least 40 K; and

wherein the cooling apparatus is arranged to cool the at least a portion of the internal wall to a temperature of 77K or below.

2. The lithographic apparatus arranged to project a pattern from a patterning device onto a substrate, the lithographic apparatus comprising:

at least one housing comprising at least one internal wall;

at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall and configured to receive a radiation beam;

a cooling apparatus arranged to cool at least a portion of the at least one internal wall to a temperature below that of the at least one optical component such that during use of the cooling apparatus at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component; and

wherein the cooling apparatus is arranged to cool the at least a portion of the internal wall to a temperature of 77 K or below.

3. The lithographic apparatus arranged to project a pattern from a patterning device onto a substrate, the lithographic apparatus comprising:

at least one housing comprising at least one internal wall;

at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall and configured to receive a radiation beam;

a cooling apparatus arranged to cool at least a portion of the at least one internal wall to a temperature below that of the at least one optical component such that during use of the cooling apparatus at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component; and

wherein the lithographic apparatus is arranged to provide an ultra-high vacuum within a chamber at least partially defined by the at least one internal wall.

4. The lithographic apparatus arranged to project a pattern from a patterning device onto a substrate, the lithographic apparatus comprising:

at least one housing comprising at least one internal wall;

at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall and configured to receive a radiation beam;

a cooling apparatus arranged to cool at least a portion of the at least one internal wall to a temperature below that of the at least one optical component such that during use of the cooling apparatus at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component; and

wherein the at least one contaminant comprises at least one of hydrocarbons and water.

5. The lithographic apparatus arranged to project a pattern from a patterning device onto a substrate, the lithographic apparatus comprising:

at least one housing comprising at least one internal wall;

at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall and configured to receive a radiation beam;

a cooling apparatus arranged to cool at least a portion of the at least one internal wall to a temperature below that of the at least one optical component such that during use of the cooling apparatus at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component; and

wherein the cooling apparatus is arranged to provide liquid nitrogen to the at least one internal wall.

6. A lithographic apparatus arranged to project a pattern from a patterning device onto a substrate, the lithographic apparatus comprising:

at least one housing comprising at least one internal wall;

at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall and configured to receive a radiation beam;

a cooling apparatus arranged to cool at least a portion of the at least one internal wall to a temperature below that of the at least one optical component such that during use of the cooling apparatus at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component;

wherein the lithographic apparatus further comprising at least one further cooling apparatus, the at least one further cooling apparatus arranged to cool the at least one optical component;

wherein the at least one further cooling apparatus comprises a substrate cooling apparatus arranged to cool the substrate;

wherein the substrate cooling apparatus comprises apparatus arranged to cool a substrate table constructed to hold the substrate; and

wherein the substrate cooling apparatus comprises;

a coolant container within, or in thermal communication with, the substrate table;

a coolant supply apparatus arranged for releasable connection to the coolant container and arranged to provide coolant to the coolant container and to drain spent coolant from the coolant container.

7. The lithographic apparatus of claim 6, wherein the coolant container is arranged to hold liquid nitrogen at a pressure of 30 bar.

8. The lithographic apparatus of any of claims 6 to 7, wherein the at least one optical component comprises a material having a zero-crossing-temperature of a coefficient of thermal expansion and the cooling apparatus is arranged to cool the at least one optical component such that the at least one optical component is maintained within a predetermined range of temperatures around the zero-crossing-temperature during an exposure operation of the lithographic apparatus.

9. The lithographic apparatus of any one of claims 6 to 8, wherein the at least one further cooling apparatus is arranged to cool the at least one optical component to a temperature of between approximately 122 and 125 K.

10. The lithographic apparatus of any one of claims 6 to 9, wherein the at least one further cooling apparatus is arranged to provide liquid nitrogen to the at least one optical component or to a component in thermal contact with the at least one optical component.

11. A method comprising:

cooling at least a portion of at least one internal wall of a lithographic apparatus arranged to project a pattern from a patterning device onto a substrate,

the cooling comprising cooling to a temperature below that of at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall, the optical component configured to receive a radiation beam; and

the cooling being such that during the cooling at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component; and

wherein cooling at least a portion of at least one internal wall cools the at least a portion of the internal wall to a temperature of 77 K or below.

12. The method of claim 11, wherein cooling at least a portion of at least one internal wall is performed prior to an exposure operation of the lithographic apparatus.

13. The method of claim 11 or 12, wherein cooling at least a portion of at least one internal wall provides a difference in temperature between the at least a portion of the at least one internal wall and the at least one optical component of at least 40 K.

14. The method of any of claims 11 to 13, wherein the cooling provides an ultra-high vacuum within a chamber at least partially defined by the at least one internal wall.

15. The method of any of claims 11 to 14, wherein the at least one contaminant comprises at least one of hydrocarbons and water.

16. The method of any of claims 11 to 15, wherein cooling at least a portion of at least one internal wall comprises providing liquid nitrogen to the at least one internal wall.

17. A method comprising:

cooling at least a portion of at least one internal wall of a lithographic apparatus arranged to project a pattern from a patterning device onto a substrate,

the cooling comprising cooling to a temperature below that of at least one optical component arranged within at least one chamber defined at least in part by the at least one internal wall, the optical component configured to receive a radiation beam;

the cooling being such that during the cooling at least one contaminant within the housing rests preferentially on the internal wall relative to the optical component; and

wherein the method further comprising cooling the at least one optical component;

wherein cooling the at least one optical component comprises cooling the substrate; and

wherein cooling the at least one optical component comprises cooling the at least one optical component such that the at least one optical component is maintained within a predetermined range of temperatures around a zero-crossing-temperature of a coefficient of thermal expansion of the optical component during an exposure operation of the lithographic apparatus.

18. The method of claim 17, wherein cooling the at least one optical component comprises cooling the at least one optical component to a temperature of between approximately 122 and 125 K prior to an exposure operation of the lithographic apparatus.

19. The method of any one of claims 17 and 18 wherein cooling the at least one optical component comprises providing liquid nitrogen to the at least one optical component or to a component in thermal contact with the at least one optical component.

20. A lithographic apparatus arranged to project a pattern from a patterning device onto a substrate, the lithographic apparatus comprising:

at least one optical component configured to receive a radiation beam; and

at least one cooling apparatus arranged to cool the at least one optical component;

wherein the at least one optical component comprises a material having a zero-crossing-temperature of a coefficient of thermal expansion and the at least one cooling apparatus is arranged to cool the at least one optical component such that the at least one optical component is maintained within a predetermined range of temperatures around the zero-crossing-temperature during an exposure operation of the lithographic apparatus; and

wherein the at least one optical component is constructed from silicon.

21. The lithographic apparatus of claim 20, wherein the at least one cooling apparatus is arranged to cool the at least one optical component to a temperature of between approximately 122 and 125 K prior to an exposure operation of the lithographic apparatus.

22. The lithographic apparatus of claim 20, wherein the at least one cooling apparatus is arranged to cool the at least one optical component to a temperature of approximately 123 K during an exposure operation of the lithographic apparatus.

23. The lithographic apparatus of claim 20, wherein the at least one cooling apparatus comprises a substrate cooling apparatus arranged to cool the substrate, and wherein the substrate cooling apparatus is arranged to cool a substrate table constructed to hold the substrate.

24. The lithographic apparatus of claim 23, wherein the substrate cooling apparatus comprises:

a coolant container within, or in thermal communication with, the substrate table;

a coolant supply apparatus arranged for releasable connection to the coolant container and arranged to provide coolant to the coolant container and to drain spent coolant from the coolant container.

25. The lithographic apparatus of claim 24, wherein the coolant container is arranged to hold liquid nitrogen at a pressure of 30 bar.