Claims:

1. A liquid immersion exposure apparatus arranged to expose substrate with an exposure beam via an optical assembly and immersion fluid, the apparatus comprising:

a liquid immersion member arranged at a surrounding of the optical assembly to supply immersion fluid to a space under the optical assembly and to recover immersion fluid from under the optical assembly;

first and second stages arranged to be positioned under the optical assembly and to hold substrate;

a movable member arranged to be independently movable with respect to each of the first and second stages and arranged to be movable away from under the optical assembly;

a drive system arranged to drive the first stage, the second stage and the movable member; and

a control system arranged to control the drive system,

wherein the control system is arranged to control the drive system so that the movable member is arranged opposite to the optical assembly to substantially maintain immersion fluid under the optical assembly even when the first and second stages are positioned away from under the optical assembly for replacement of one stage of the first and second stages with the other stage.

2. The liquid immersion exposure apparatus according to claim 1,

wherein the one stage and the movable member are arranged to be movable such that immersion fluid is substantially maintained under the optical assembly in a transition from a first state, in which immersion fluid is held between the optical assembly and the one stage, to a second state, in which immersion fluid is held between the optical assembly and the movable member.

3. The liquid immersion exposure apparatus according to claim 2,

wherein the one stage and the movable member are arranged to be aligned such that the one stage and the movable member move in unison with each other in the transition from the first stage to the second state.

4. The liquid immersion exposure apparatus according to claim 2 or 3,

wherein, before the transition from the first state to the second state, the one stage and the movable member are arranged such that the one stage and the movable member are arranged adjacent to each other and such that a surface of the one stage is substantially coplanar with a surface of the movable member.

5. The liquid immersion exposure apparatus according to any one of claims 2 to 4,
wherein the other stage and the movable member are arranged to be movable during a transition from the second state to a third state in which immersion fluid is held between the optical assembly and the other stage such that immersion fluid is substantially maintained under the optical assembly.

6. The liquid immersion exposure apparatus according to any one of claims 1 to 5,
wherein the movable member and the one stage or the other stage are arranged to be adjacent to each other and to form a substantial continuous surface.

7. The liquid immersion exposure apparatus according to any one of claims 1 to 6,
wherein the movable member and the other stage are arranged opposite to the optical assembly while a first process, which is for substrate held on the one stage, is executed.

8. The liquid immersion exposure apparatus according to claim 7,
wherein the first process includes at least one of a substrate exchange process, an alignment process and a measurement process.

9. The liquid immersion exposure apparatus according to any one of claims 1 to 8,
wherein the movable member or the one stage is arranged opposite to the optical assembly while a second process, which is for substrate held on the other stage, is executed.

10. The liquid immersion exposure apparatus according to claim 9,
wherein the second process includes at least one of a substrate exchange process, an alignment process and a measurement process.

11. The liquid immersion exposure apparatus according to any one of claims 1 to 10,
wherein the movable member is arranged to be movable relative to the one stage so that the movable member is adjacent to the one stage positioned facing the optical assembly, and
wherein, when the one stage and the movable member are arranged adjacent to each other, the one stage and the movable member are movable relative to the optical assembly such that the one stage is replaced with the movable member

while immersion fluid is substantially maintained under the optical assembly.

12. The liquid immersion exposure apparatus according to any one of claims 1 to 11,
wherein, after the exposure of substrate held on the one stage, the one stage and the movable member arranged adjacent to each other are moved relative to the optical assembly so that the movable member is arranged apposite to the optical assembly in place of the one stage.

13. The liquid immersion exposure apparatus according to any one of claims 1 to 12,
wherein the one stage and the movable member arranged adjacent to each other are arranged movable relative to the optical assembly so that immersion fluid is substantially maintained under the optical assemble by at least one of the one stage and the movable member.

14. The liquid immersion exposure apparatus according to any one of claims 1 to 13,
wherein, while the first or the second stage is arranged under the optical assembly, the second or the first stage is positioned away from under the optical assembly.

15. The liquid immersion exposure apparatus according to any one of claims 1 to 14,
wherein a process for substrate held on the one stage is performed in parallel with a process for substrate held on the other stage.

16. The liquid immersion exposure apparatus according to any one of claims 1 to 15,
wherein, during an exposure process for substrate held on the first or the second stage, the second or the first stage is arranged away from under the optical assembly.

17. The liquid immersion exposure apparatus according to any one of claims 1 to 16,
wherein the drive system has a mode in which the one stage is replaced with the other stage while immersion fluid is substantially maintained under the optical assembly, the mode including a first process in which the one stage and the movable member arranged adjacent to each other are moved relative to the optical assembly so that the movable member is arranged opposite to the optical assembly in place of the one stage, and a second process in which the movable member and the other stage arranged adjacent to each other are moved relative to the optical assembly so that the other stage is arranged opposite to the optical assembly in place of the movable member.

18. The liquid immersion exposure apparatus according to any one of claims 1 to 17,
wherein the movable member includes a pad stage.

19. The liquid immersion exposure apparatus according to any one of claims 1 to 18,
wherein the movable member is a stage provided with no holder for holding substrate.

20. A device fabricating method comprising:
exposing substrate by use of a liquid immersion exposure apparatus of any one of claims 1 to 19.

21. A liquid immersion exposure method of exposing substrate with an exposure beam via an optical assembly and immersion fluid, the method comprising:
positioning a first stage, on which substrate is held, under the optical assembly such that immersion fluid is held between the first stage and the optical assembly;
replacing the first stage under the optical assembly with a second stage, while immersion fluid is maintained under the optical assembly; and
positioning a movable member to a position opposite to the optical assembly in the replacement process of the first stage with the second stage such that immersion fluid liquid immersion is maintained under the optical assembly even when the first and second stages are positioned away from under the optical assembly, the movable member being arranged to be independently movable with respect to each of the first and second stages and arranged to be movable away from under the optical assembly.

22. The liquid immersion exposure method according to claim 21,
wherein the first stage and the movable member are moved such that immersion fluid is substantially maintained under the optical assembly in a transition from a first state, in which immersion fluid is held between the optical assembly and the first stage, to a second state, in which immersion fluid is held between the optical assembly and the movable member.

23. The liquid immersion exposure method according to claim 22,
wherein the first stage and the movable member are moved in unison with each other in the transition from the first stage to the second state.

24. The liquid immersion exposure method according to claim 22 or 23,
wherein, before the transition from the first state to the second state, the first stage and the movable member are arranged such that the first stage and the movable member are arranged adjacent to each other and such that a surface of the first stage is substantially coplanar with a surface of the movable member.

25. The liquid immersion exposure method according to any one of claims 22 to 24,
wherein the second stage and the movable member are arranged to be movable during a transition from the second state to a third state in which immersion fluid is held between the optical assembly and the second stage such that immersion fluid is substantially maintained under the optical assembly.

26. The liquid immersion exposure method according to any one of claims 21 to 25,
wherein the movable member and the first stage or the second stage are arranged adjacent to each other and to form a substantial continuous surface in the replacement.

27. The liquid immersion exposure method according to any one of claims 21 to 26,
wherein the movable member and the second stage are arranged opposite to the optical assembly while a first process, which is for substrate held on the first stage, is executed.

28. The liquid immersion exposure method according to claim 27,
wherein the first process includes at least one of a substrate exchange process, an alignment process and a measurement process.

29. The liquid immersion exposure method according to any one of claims 21 to 28,
wherein the movable member or the first stage is arranged opposite to the optical assembly while a second process, which is for substrate held on the second stage, is executed.

30. The liquid immersion exposure method according to claim 29,
wherein the second process includes at least one of a substrate exchange process, an alignment process and a measurement process.

31. The liquid immersion exposure method according to any one of claims 21 to 30,

wherein the movable member is moved relative to the first stage so that the movable member is adjacent to the first stage positioned facing the optical assembly, and

wherein, when the first stage and the movable member are arranged adjacent to each other, the first stage and the movable member are moved relative to the optical assembly such that the first stage is replaced with the movable member while immersion fluid is substantially maintained under the optical assembly.

32. The liquid immersion exposure method according to any one of claims 21 to 31,

wherein, after the exposure of substrate held on the first stage, the first stage and the movable member arranged adjacent to each other are moved relative to the optical assembly so that the movable member is arranged apposite to the optical assembly in place of the first stage.

33. The liquid immersion exposure method according to any one of claims 21 to 32,

wherein the first stage and the movable member arranged adjacent to each other are moved relative to the optical assembly so that immersion fluid is substantially maintained under the optical assemble by at least one of the first stage and the movable member.

34. The liquid immersion exposure method according to any one of claims 21 to 33,

wherein, while the first or the second stage is arranged under the optical assembly, the second or the first stage is positioned away from under the optical assembly.

35. The liquid immersion exposure method according to any one of claims 21 to 34,

wherein a process for substrate held on the first stage is performed in parallel with a process for substrate held on the second stage.

36. The liquid immersion exposure method according to any one of claims 21 to 35,

wherein, during an exposure process for substrate held on the first or the second stage, the second or the first stage is arranged away from under the optical assembly.

37. The liquid immersion exposure method according to any one of claims 21 to 36,
wherein a process, in which the first stage is replaced with the second stage while immersion fluid is substantially maintained under the optical assembly, comprises a first process in which the first stage and the movable member arranged adjacent to each other are moved relative to the optical assembly so that the movable member is arranged opposite to the optical assembly in place of the first stage, and a second process in which the movable member and the second stage arranged adjacent to each other are moved relative to the optical assembly so that the second stage is arranged opposite to the optical assembly in place of the movable member.

38. The liquid immersion exposure method according to any one of claims 21 to 37,
wherein the movable member includes a pad stage.

39. The liquid immersion exposure method according to any one of claims 21 to 38,
wherein the movable member is a stage provided with no holder for holding substrate.

40. A device fabricating method comprising:
exposing substrate by use of a liquid immersion exposure method of any one of claims 21 to 39.

Claims

1. An immersion exposure apparatus for exposing a substrate with an exposure beam via an optical assembly (10) and immersion liquid, comprising:

a liquid immersion member that is arranged to surround part of the optical assembly to supply immersion liquid to below the optical assembly and to recover immersion liquid from below the optical assembly;

first and second stages (WS1, WS2), each of which is configured to support a substrate and each of which is positionable below the optical assembly;

a pad (326) that is independently movable relative to the first and second stages and away from below the optical assembly;

a drive system arranged to drive the first stage, the second stage and the pad; and

a control system (330) configured to control the drive system,

wherein the control system is configured to control the drive system to arrange the pad under the optical assembly in a process in which one of the first and second stages, which is arranged under the optical assembly, is replaced with the other of the first and second stages to substantially maintain immersion liquid below the optical assembly while the first and second substrate stages are away from below the optical assembly,

in which process the control system controls the drive system such that the pad is moved relative to the one stage located under the optical assembly so that the pad is positioned adjacent to the one stage, and the adjacent one stage and pad are moved relative to the optical assembly to locate the pad under the optical assembly in place of the one stage so that immersion liquid is substantially maintained below the optical assembly during the movement.

2. The immersion exposure apparatus according to claim 1, wherein the one stage and the pad are movable for a transition from a first state to a second state, the first state being a state in which immersion liquid is maintained in a space between the optical assembly and the one stage, the second state being a state in which immersion liquid is maintained in a space between the optical assembly and the pad, such that immersion liquid is substantially maintained below the optical assembly during the transition.

3. The immersion exposure apparatus according to claim 2, wherein the one stage and the pad are arranged to move in unison in the transition.

4. The immersion exposure apparatus according to claim 2 or 3, wherein the apparatus is configured such that prior to the transition, the one stage and the pad are positionable adjacent to each other such that a surface of the one stage and a surface of the pad are substantially coplanar.

5. The immersion exposure apparatus according to any one of claims 2 to 4, wherein the pad and the other stage are movable for a transition from the second state to a third state, the third state being a state in which immersion liquid is maintained in a space between the optical assembly and the other stage, so that immersion liquid is substantially maintained below the optical assembly during the transition.

6. The immersion exposure apparatus according to any one of claims 1 to 5, wherein the apparatus is configured such that, in the replacement, the one stage or the other stage and the pad are positionable adjacent to each other so as to form a substantially continuous surface.

7. The immersion exposure apparatus according to any one of claims 1 to 6, wherein the apparatus is configured such that the pad or the other stage is arranged facing the optical assembly while a first operation is performed on a substrate held by the one stage.

8. The immersion exposure apparatus according to claim 7, wherein the first operation includes at least one of a substrate exchange operation, an alignment operation, and a measurement operation.

9. The immersion exposure apparatus according to any one of claim 1 or 8, wherein the apparatus is configured such that the one stage or the pad is arranged facing the optical assembly while a second operation is performed on a substrate supported by the other stage.

10. The immersion exposure apparatus according to claim 9, wherein the second operation includes at least one of a substrate exchange operation, an alignment operation, and a measurement operation.

11. The immersion exposure apparatus according to any one of claims 1 to 10, wherein the apparatus is configured such that after an exposure of a supported held by the one stage, the one stage and the pad arranged adjacent to each other are moved relative to the optical assembly to locate the pad opposed to the optical assembly in place of the one stage.

12. The immersion exposure apparatus according to any one of claims 1 to 11, wherein the apparatus is configured to move the one stage and the pad arranged adjacent to each other relative to the optical assembly so that immersion liquid is substantially maintained below the optical assembly by one of the one stage and the member, or the both during the movement.

13. The immersion exposure apparatus according to any one of claims 1 to 12, wherein the apparatus is configured such that one of the first and second stages is arranged away from below the optical assembly while the other of the first and second stages is positioned below the optical assembly.

14. The immersion exposure apparatus according to any one of claim 1 to 13, wherein the apparatus is configured such that an operation on the substrate supported by the one stage is performed in parallel to an operation on the substrate held by the other stage.

15. The immersion exposure apparatus according to any one of claims 1 to 14, wherein the apparatus is configured such that one of the first and second stages is positionable away from below the optical assembly during an exposure of a substrate supported by the other of the first and second stages.

16. The immersion exposure apparatus according to any one of claims 1 to 15, wherein the control system is configured to control the drive system to move the one stage and the pad arranged adjacent to each other relative to the optical assembly to locate the pad opposed to the optical assembly in place of the one

stage and to move the pad and the other stage arranged adjacent to each other relative to the optical assembly to locate the other stage opposed to the optical assembly in place of the pad for the replacement of the one stage with the other stage so that immersion liquid is substantially maintained below the optical assembly during the replacement.

17. A device manufacturing method including a lithography process, wherein in the lithography process, a device pattern is transferred onto a substrate using the immersion exposure apparatus according to any one of claims 1 to 16.

18. An immersion exposure method for exposing a substrate with an exposure beam via an optical assembly (10) and via immersion liquid, comprising:

positioning a first stage (WS1) on which a substrate is supported below the optical assembly so that immersion liquid is maintained in a space between the optical assembly and the substrate;

replacing the first stage below the optical assembly with a second stage (WS2) on which a substrate is mounted while maintaining immersion liquid below the optical assembly,

wherein a pad (326), which is independently movable relative to the first and second stages and away from below the optical assembly, is arranged to face the optical assembly in the replacement by moving the pad relative to the one stage located opposed to the optical assembly so that the pad is positioned adjacent to the one stage, and then moving the adjacent one stage and pad relative to the optical assembly to locate the pad opposed to the optical assembly in place of the one stage so that immersion liquid is substantially maintained below the optical assembly during the movement; and

so as to substantially maintain immersion liquid below the optical assembly while the first and second stages are away from below the optical assembly.

19. The immersion exposure method according to claim 18, wherein the one stage and the pad are moved in a transition from a first state to a second state, the first state being a state in which immersion liquid is maintained in a space between the optical assembly and the respective stage, the second state being a state in which immersion liquid is maintained in a space between the optical assembly and

the pad, such that immersion liquid is substantially maintained below the optical assembly during the transition.

20. The immersion exposure method according to claim 19, wherein the one stage and the pad move in unison in the transition.

21. The immersion exposure method according to claim 19 or 20, wherein prior to the transition, the one stage and the pad are positionable adjacent to each other such that a surface of the one stage and a surface of the pad are substantially coplanar.

22. The immersion exposure method according to any one of claims 19 to 21, wherein the pad and the other stage are moved for a transition from the second state to a third state, the third state being a state in which immersion liquid is maintained in a space between the optical assembly and the other stage, so that immersion liquid is substantially maintained below the optical assembly during the transition.

23. The immersion exposure method according to any one of claims 18 to 22, wherein the one stage or the other stage and the pad are positioned adjacent to each other to form a substantially continuous surface in the replacement.

24. The immersion exposure method according to any one of claims 18 to 22, wherein the pad or the other stage is arranged facing the optical assembly while a first operation is performed on a substrate supported by the one stage.

25. The immersion exposure method according to claim 24, wherein the first operation includes at least one of a substrate exchange operation, an alignment operation, and a measurement operation.

26. The immersion exposure method according to any one of claim 18 or 25, wherein the one stage or the pad is arranged facing the optical assembly while a second operation is performed on a substrate supported by the other stage.

27. The immersion exposure method according to claim 26, wherein the second operation includes at least one of a substrate exchange operation; an alignment operation, and a measurement operation.

28. The immersion exposure method according to any one of claims 18 to 27, wherein after an exposure of a substrate supported by the one stage, the one stage and the pad arranged adjacent to each other are moved relative to the optical assembly to locate the pad opposed to the optical assembly in place of the one stage.

29. The immersion exposure method according to any one of claims 18 to 28, wherein the one stage and the pad arranged adjacent to each other are moved relative to the optical assembly so that immersion liquid is substantially maintained below the optical assembly by one of the one stage and the pad , or the both during the movement.

30. The immersion exposure method according to any one of claims 18 to 29, wherein one of the first and second stages is arranged away from below the optical assembly while the other of the first and second stages is positioned below the optical assembly.

31. The immersion exposure method according to any one of claim 18 to 30, wherein an operation on the substrate supported by the one stage is performed in parallel to an operation on the substrate held by the other stage.

32. The immersion exposure method according to any one of claims 18 to 31, wherein one of the first and second stages is positioned away from below the optical assembly during an exposure of a substrate supported by the other of the first and second stages.

33. The immersion exposure method according to any one of claims 18 to 32, wherein the one stage and the pad arranged adjacent to each other are moved relative to the optical assembly to locate the pad opposed to the optical assembly in place of the one stage and the pad and the other stage arranged adjacent to each other are moved relative to the optical assembly to locate the other stage

opposed to the optical assembly in place of the pad for the replacement of the one stage with the other stage so that immersion liquid is substantially maintained below the optical assembly during the replacement.

34. A device manufacturing method including a lithography process, wherein in the lithography process, a device pattern is transferred onto a substrate using the immersion exposure method according to any one of claims 18 to 33.