WHAT IS CLAIMED IS:

1. An exposure apparatus comprising:

a first substrate holder configured to hold a substrate;

a second substrate holder configured to hold the substrate;

a sensor holder configured to hold a sensor and/or a detector;

a projection system configured to project a pattern imparted to a radiation beam by a patterning device onto a target portion of the substrate;

a measurement device configured to provide measurement information of the substrate; and

a further measurement device configured to provide further measurement information of the substrate,

wherein the measurement device provides information about in-plane deformation of the substrate and/or information about a height profile of the substrate,

wherein the further measurement device configured to provide information about positions of substrate alignment marks on the substrate,

wherein the measurement device measures the positions of both a substrate alignment mark, which is located in space between the target portions on the substrate, and an overlay mark, which is located in the target portion on the substrate.

2. An exposure apparatus comprising:

a first substrate holder configured to hold a substrate;

a second substrate holder configured to hold the substrate;

a sensor holder configured to hold a sensor and/or a detector;

a projection system configured to project a pattern imparted to a radiation beam by a patterning device onto a target portion of the substrate;

a measurement device configured to provide information about in-plane deformation of the substrate and/or information about a height profile of the substrate;

a further measurement device configured to provide information about positions of substrate alignment marks on the substrate; and

a movement device configured to transport the substrate from the first substrate holder to the second substrate holder.

3. An exposure apparatus comprising:

a first substrate holder configured to hold a substrate;

a second substrate holder configured to hold the substrate;
a sensor holder configured to hold a sensor and/or a detector;
a projection system configured to project a pattern imparted to a radiation beam by a patterning device onto a target portion of the substrate, the projection system comprising: a lens barrel; an optical element; and a lens holder configured to hold the optical element;
a measurement device configured to provide information about in-plane deformation of the substrate and/or information about a height profile of the substrate;
a further measurement device configured to provide information about positions of substrate alignment marks on the substrate; and
a control unit configured: to implement desired calculations relevant to the operation of the exposure; to process multiple signals; to execute an algorithm; to control a position of the second substrate holder; to control an optical property of an aerial image; and/or to control an optical property of the projection system,
wherein the control unit is configured to compensate for distortion of an image to be projected onto the substrate, an aberration of the projection system, a deformation of the substrate, an inter-field distortion, an intra-field distortion, inter-field overlay errors and/or intra-field overlay errors, and
wherein the control unit compensates for inter-field overlay errors and/or intra-field overlay errors, based on a fine distortion map and/or a combined distortion map, by controlling: a position of the second substrate holder, an optical property of the aerial image, an optical property of the projection system, and/or a position and/or orientation of the optical element with respect to the lens barrel.

4. The exposure apparatus according to claim 3, wherein the measurement device is configured to provide fine alignment information based on a large number of measurements.

5. The exposure apparatus according to claim 4, wherein the further measurement device is configured to provide coarse wafer alignment information based on between 3 and 16 substrate alignment marks on the substrate.

6. The exposure apparatus according to claim 5, wherein the coarse wafer alignment information is information about a shape of the substrate, a position of the substrate, and/or, an in-plane deformation of the substrate.

7. The exposure apparatus of claim 5 or 6, wherein the control unit is configured: to create the fine distortion map based on the fine alignment information, to create a coarse distortion map based on coarse alignment information, and/or to create the combined distortion map by combining the fine distortion map and the coarse distortion map.

8. The exposure apparatus of any one of claims 3 to 7, wherein an optical property of the aerial image and/or an optical property of the projection system, which the control unit controls, includes magnification-X, magnification-Y, distortion, coma, field curvature, spherical aberration, and/or astigmatism.

9. The exposure apparatus of any one of claims 1 to 8, wherein the measurement device comprises a first alignment system that comprises a single alignment sensor.

10. The exposure apparatus of any one of claims 1 to 9, wherein the further measurement device comprises a second alignment system.

11. The exposure apparatus of claim 10, wherein the second alignment system comprises a plurality of alignment sensors.

12. The exposure apparatus of claim 2 or 3, the measurement device measures the positions of both a substrate alignment mark, which is located in space between the target portions on the substrate, and an overlay mark, which is located in the target portion on the substrate.

13. The exposure apparatus of claim 1 or 12, wherein the summation of numbers of the substrate alignment marks and/or the overlay marks on the substrate measured by the measurement device is greater than or equal to 96.

14. The exposure apparatus according to any one of claims 1 to 13, wherein the measurement device is located further away from the projection system than the further measurement device.

15. The exposure apparatus of any one of claims 1 to 14, wherein the exposure apparatus is arranged to hold the substrate on the first substrate holder while the measurement device is acquiring the measurement information from the substrate,

and wherein the exposure apparatus is arranged to hold the substrate on the second substrate holder while the further measurement device is acquiring the further measurement information from the substrate.

16. The exposure apparatus of any one of claims 1 to 15, wherein the exposure apparatus comprises a first scale arranged at a bottom surface of the first substrate holder.

17. The exposure apparatus of any one of claims 1 to 16, wherein the exposure apparatus comprises a first encoder head located beneath the measurement device.

18. The exposure apparatus of any one of claims 1 to 17, wherein the exposure apparatus comprises a first position measurement system arranged to provide a first signal representative of positional information of the first substrate holder while the first substrate holder is near or at the measurement device.

19. The exposure apparatus of any one of claims 1 to 18, wherein the exposure apparatus comprises a second position measurement system arranged to provide a second signal representative of positional information of the second substrate holder and/or the sensor holder when located near or at the projection system.

20. The exposure apparatus of claim 19, wherein the second position measurement system comprises: a second encoder head; and a second scale arranged at a surface of the second substrate holder,
wherein the second encoder head is located to face the second scale while the second substrate holder is near or at the projection system.

21. The exposure apparatus of claim 20, wherein the second position measurement system further comprises a third scale arranged at a surface of the sensor holder,
wherein the second encoder head is located to face the third scale while the sensor holder is near or at the projection system.

22. The exposure apparatus of any one of claims 1 to 21, wherein the exposure apparatus comprises an aerial image measuring device configured to measure an aerial image of the pattern projected by the projection system.

23. The exposure apparatus of claim 22, wherein the second substrate holder comprises a marker, wherein the aerial image measuring device comprises the marker on the second substrate holder and the detector on the sensor holder.

24. The exposure apparatus of any one of claims 1 to 23, wherein the sensor holder holds a wavefront aberration measuring device, an illuminance monitor, an illuminance irregularity sensor, and/or a uniformity sensor.

25. The exposure apparatus according to any one of claims 1 to 24, wherein the further measurement device comprises an auto-focus system.

26. The exposure apparatus according to claim 25, wherein the auto-focus system comprises a light source to provide a beam of radiation at a slanted angle directed to the top surface of the substrate, and is configured to provide information about a flatness of the substrate held by the second substrate holder based on a reflected light reflected by the top surface of the substrate.

27. The exposure apparatus according to any one of claims 1 to 26, wherein the information about the height profile of the substrate provided by the measurement device is information about a flatness of the substrate.

28. The exposure apparatus according to claim 27, wherein the information about the flatness of the substrate provided by the measurement device is information about a flatness of the substrate held by the first substrate holder.

29. The exposure apparatus of any one of claims 1 to 28, comprising a liquid handling system configured to supply and confine immersion liquid to a space defined between the projection system and at least one of the first substrate holder, the second substrate holder, the substrate, and the sensor holder.

30. The exposure apparatus of claim 29, wherein the liquid handling system comprises a recovery port configured to recover the immersion liquid from the space.

31. The exposure apparatus of claim 30, wherein a porous member is disposed in the recovery port.