Claims

1. A coaxial reticle alignment device for aligning a reticle with a workpiece stage, comprising:

an illumination module, configured to irradiate an alignment light beam onto a first reticle alignment mark or a second reticle alignment mark on the reticle;

a projection objective, disposed under the reticle and configured to respectively image the first and second reticle alignment marks;

a reference plate, disposed on the workpiece stage and configured to carry a reference mark; and

an image detection and processing module arranged on the workpiece stage, wherein the reference mark is located within a field of view of the image detection and processing module, and wherein during movement of the workpiece stage relative to the reticle, the image detection and processing module receives a first alignment light beam that has passed sequentially through the first reticle alignment mark, the projection objective and the reference mark and a second alignment light beam that has passed sequentially through the second reticle alignment mark, the projection objective and the reference mark and hence captures images of the first and second reticle alignment marks and the reference mark, which are processed to derive relative positional information between the first reticle alignment mark and the reference mark and between the second reticle alignment mark and the reference mark, so as to align the reticle with the workpiece stage,

wherein the reference mark and the image detection and processing module are shared by the first and second reticle alignment marks, and

wherein the image detection and processing module is spaced apart from an edge of the

reference plate by a distance that is at least equal to d×M+φ/2, where d represents a distance between the first reticle alignment mark and the second reticle alignment mark on the reticle; M represents a magnification of the projection objective; and φ represents a diameter of a blur spot formed on a focal plane of the projection objective by the alignment light beam passing through the projection objective.

2. The coaxial reticle alignment device according to claim 1, wherein two illumination modules are included, each of the illumination modules corresponding to a respective one of the first and second reticle alignment marks.

3. The coaxial reticle alignment device according to claim 1, wherein the reference mark is positioned at an optimum focal plane of the image detection and processing module.

4. The coaxial reticle alignment device according to claim 1, wherein the image detection and processing module comprises an imaging lens group, a detector and a processing unit.

5. The coaxial reticle alignment device according to claim 6, wherein the detector is a CCD or CMOS device.

6. The coaxial reticle alignment device according to claim 2, wherein alignment light beams provided by the illumination modules have a same wavelength.

7. The coaxial reticle alignment device according to claim 6, wherein the illumination modules provide alignment light beams in an ultraviolet spectrum.

8. A lithography apparatus, comprising a coaxial reticle alignment device for aligning a reticle with an object to be exposed on a workpiece stage, wherein the coaxial reticle alignment device is implemented according to claim 1.

9. A reticle alignment method, comprising the steps in the sequence set forth:

1) irradiating a first alignment light beam emanated from a first illumination module

onto a first reticle alignment mark on a reticle and moving a workpiece stage so that the first alignment light beam passes through a projection objective and is incident on a reference mark on the workpiece stage;

2) receiving, by an image detection and processing module disposed on the workpiece stage, the first alignment light beam that has passed sequentially through the first reticle alignment mark, the projection objective and the reference mark and hence capturing images of the first reticle alignment mark and the reference mark, which are then processed to derive first relative positional information between the first reticle alignment mark and the reference mark;

3) irradiating a second alignment light beam emanated from a second illumination module onto a second reticle alignment mark on the reticle and moving the workpiece stage so that the second alignment light beam passes through the projection objective and is incident on the reference mark, wherein during movement of the workpiece stage, the reference mark is located within a field of view of the image detection and processing module; and

4) receiving, by the image detection and processing module, the second alignment light beam that has passed sequentially through the second reticle alignment mark, the projection objective and the reference mark and hence capturing images of the second reticle alignment mark and the reference mark, which are then processed to derive second relative positional information between the second reticle alignment mark and the reference mark, and aligning the reticle with the workpiece stage based both on the first relative positional information between the first reticle alignment mark and the reference mark and on the second relative positional information between the second reticle alignment mark and the reference mark, wherein the reference mark and the image detection and processing module

are shared by the first and second reticle alignment marks,

wherein the image detection and processing module is spaced apart from an edge of the reference plate by a distance that is at least equal to $d \times M + \varphi/2$, where d represents a distance between the first reticle alignment mark and the second reticle alignment mark on the reticle; M represents a magnification of the projection objective; and φ represents a diameter of a blur spot formed on a focal plane of the projection objective by the first or second alignment light beam passing through the projection objective.

10. A reticle alignment method, comprising the steps in the sequence set forth:

1) irradiating a first alignment light beam emanated from a first illumination module onto a first reticle alignment mark on a reticle and a second alignment light beam emanated from a second illumination module onto a second reticle alignment mark on the reticle and moving a workpiece stage, so that the first alignment light beam passes through a projection objective and is incident on a reference mark on a reference plate, the reference mark is located within a field of view of the image detection and processing module;

2) receiving, by an image detection and processing module disposed on the workpiece stage, the first alignment light beam that has passed sequentially through the first reticle alignment mark, the projection objective and the reference mark and hence capturing images of the first reticle alignment mark and the reference mark, which are then processed to derive first relative positional information between the first reticle alignment mark and the reference mark;

3) moving the workpiece stage so that the second alignment light beam passes through the projection objective and is incident on the reference mark; and

4) receiving, by the image detection and processing module, the second alignment light beam that has passed sequentially through the second reticle alignment mark, the projection

objective and the reference mark and hence capturing images of the second reticle alignment mark and the reference mark, which are then processed to derive second relative positional information between the second reticle alignment mark and the reference mark, and aligning the reticle with the workpiece stage based both on the first relative positional information between the first reticle alignment mark and the reference mark and on the second relative positional information between the second reticle alignment mark and the reference mark, wherein the reference mark and the image detection and processing module are shared by the first and second reticle alignment marks,

wherein the image detection and processing module is spaced apart from an edge of the reference plate by a distance that is at least equal to $d \times M + \varphi/2$, where d represents a distance between the first reticle alignment mark and the second reticle alignment mark on the reticle; M represents a magnification of the projection objective; and φ represents a diameter of a blur spot formed on a focal plane of the projection objective by the first or second alignment light beam passing through the projection objective.

11. The reticle alignment method according to claim 10, wherein in step 1, upon the first alignment light beam passing through the projection objective and irradiating onto the reference mark on the workpiece stage, the second alignment light beam is offset from the reference plate.