CLAIMS

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A method for pretreating an EUVL photomask having an exposed ruthenium surface, the method comprising:

subjecting the photomask to surface treatment in an oxidizing and reducing environment.

2. The method of Claim 1, wherein subjecting the photomask to an oxidizing and reducing environment includes treatment with water vapor plasma.

3. The method of Claim 1, wherein subjecting the photomask to an oxidizing and reducing environment includes treatment with hydroxyl OH* and hydrogen radicals H*.

4. The method of Claim 1, wherein the surface treatment oxidizes carbon on the surface of the photomask.

5. The method of Claim 1, wherein the surface treatment reduces the exposed ruthenium surface.

6. A method for cleaning an EUVL photomask having an exposed ruthenium surface, the method comprising:

(a) subjecting the photomask to surface treatment in an oxidizing and reducing environment; and

(b) cleaning the photomask with a cleaning solution.

7. The method of Claim 6, wherein subjecting the photomask to an oxidizing and reducing environment includes treatment with water vapor plasma.

8. The method of Claim 6, wherein subjecting the photomask to an oxidizing and reducing environment includes treatment with hydroxyl OH* and hydrogen radicals H*.

9. The method of Claim 6, wherein the surface treatment oxidizes carbon on the surface of the photomask.

10. The method of Claim 6, wherein the surface treatment reduces the exposed ruthenium surface.

11. The method of Claim 6, wherein the cleaning solution includes ammonium hydroxide, hydrogen peroxide, and deionized water.