Claims

1. 1. An apparatus comprising:

a vacuum chamber; :

a stage disposed in the vacuum chamber that is configured to secure a wafer;

a laser light source disposed outside the vacuum chamber, wherein the laser light source includes a plurality of lasers;

an optical fiber that simultaneously transmits all wavelengths of light produced by the laser light source into the

vacuum chamber through a wall of the vacuum chamber, wherein the light from the laser light source is at more than one wavelength; and

an achromatization and polarization unit disposed in the vacuum chamber, wherein the achromatization and polarization unit receives light from the optical fiber.

2. .

2. The apparatus of claim 1, further comprising an electron beam source that directs an electron beam at the stage.

3.

3. The apparatus of claim 1, wherein the optical fiber transmits light at a wavelength from 200 nm to 2000 nm.

4.

4. The apparatus of claim 1, wherein the laser light source includes a plurality of lasers and a plurality of dichroic mirrors.

5. The apparatus of claim 1, wherein the laser light source further includes a plurality of dichroic mirrors.

5. The apparatus of claim 1, wherein the laser light source further includeslasers, a polarization-dependent beam splitterssplitters, and a plurality of half-wave plates.

6.

~~6.~~ The apparatus of claim 1, wherein the optical fiber is a multi-mode fiber.

7. ~~–~~The apparatus of claim 1, wherein the optical fiber is a single-mode fiber.

8.

~~8.~~ The apparatus of claim 1, further comprising a wave plate disposed in the vacuum chamber that receives the light from the optical fiber.

9.

~~9.~~ The apparatus of claim 8, wherein the wave plate is a half-wave or a quarter-wave plate.

10.

~~10.~~ The apparatus of claim 1, wherein the achromatization and polarization unit includes: a turning mirror disposed in the vacuum chamber, wherein the turning mirror receives the light from the optical fiber and is configured to direct the light from the optical fiber at the stage; and

at least one achromatized lens disposed in the vacuum chamber, wherein the achromatized lens is configured to collimate the light received from the optical fiber and/or image the light onto the wafer.

11. The apparatus of claim 1, wherein the achromatization and polarization unit includes a curved mirror, wherein the curved mirror is spherical or parabolic.

~~11.~~

12.~~The apparatus of Claim 1, wherein the achromatization and polarization unit inch des a curved mirror, wherein the curved mirror is spherical or parabolic.~~

~~12. The apparatus of claim 1, wherein the light from the laser light source is at more than one wavelength.~~

~~13.~~ The apparatus of claim 1, further comprising a flange around the optical fiber, wherein the flange is disposed in the wall of the vacuum chamber, and wherein the flange includes:

an outer component disposed around the optical fiber; and

a polymer layer disposed between the optical fiber and the outer component, wherein the polymer layer is radially compressed to form a hermetic seal.

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~~14~~. The apparatus of claim 12~~13~~, wherein the hermetic seal between~~.~~ the wall and the tube further includes using a metal-to-metal seal.

14.

~~15.~~ The apparatus of claim 1, further comprising a flange around the optical fiber, wherein the flange is disposed in the wall of the vacuum chamber, wherein the flange is an elastomer seal, and wherein the elastomer seal is radially compressed to form a hermetic seal.

15.

~~16.~~ A method comprising:

directing light from a plurality of lasers in a laser light source to a vacuum chamber through an optical fiber, wherein the optical fiber simultaneously transmits all wavelengths of light

produced by the laser light source into the vacuum chamber through a wall of the vacuum chamber, wherein the light from the laser light source is at more than one wavelength; ; directing the light from the optical fiber to an achromatization and polarization unit in the vacuum chamber; and directing the light to a wafer secured on a stage disposed in the vacuum chamber.

16.

17. The method of claim 1516, further comprising directing an electron beam in the vacuum chamber at the wafer.

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18. The method of claim 1516, wherein the light has a wavelength from 200 nm to 2000 nm.

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~~19~~. The method of claim 15~~16~~, wherein the achromatization and polarization unit includes a turning mirror or a curved mirror.