Claims

1. A beam shaper for an optical inspection tool, comprising: a focal lens to focus an optical beam onto a target at an oblique angle of incidence; and a phase modulator to substantially flatten a top of the optical beam in the plane of the target when the optical beam is focused onto the target at the oblique angle of incidence, the phase modulator comprising a diffractive optical element (DOE) that instantiates a convolution of a symmetrical phase term with an asymmetrical phase term to produce a substantially symmetric beam profile in the plane of the target when the optical beam is focused onto the target at the oblique angle of incidence.

2. The beam shaper of claim 1, further comprising a chuck on which the target is to be mounted, wherein the focal lens is situated between the phase modulator and the chuck in an optical path for the optical beam.

3. The beam shaper of claim 2, wherein the optical beam as incident upon the phase modulator is substantially Gaussian.

4. The beam shaper of claim 2, wherein no optical element is present between the phase modulator and the focal lens.

5. The beam shaper of claim 1, wherein the phase modulator is configured to flatten the top of the optical beam such that the intensity of the optical beam across a width corresponding to an inspection track varies by no more than 10 percent in the plane of the target when the optical beam is focused onto the target at the oblique angle of incidence.

6. The beam shaper of claim 1, wherein cross-sections of the DOE that are perpendicular to a radial axis of the optical beam are substantially wedge-shaped.

7. The beam shaper of claim 1, wherein the DOE is shaped to produce respective beam profiles with distinct phases for distinct slices of the DOE, the distinct slices being perpendicular to a plane of incidence of the optical beam, wherein combination of the distinct phases smooths out spikes in the top of the beam.

8. The beam shaper of claim 1, wherein: the target is a semiconductor wafer; and the phase modulator is configured to substantially flatten the top of the optical beam in a plane corresponding to a surface of the semiconductor wafer onto which the optical beam is focused.

9. A beam shaper for an optical inspection tool, comprising: a focal lens to focus an optical beam onto a target at an oblique angle of incidence; a diffractive optical element (DOE) to substantially flatten a top of the optical beam in the plane of the target when the optical beam is focused onto the target at the oblique angle of incidence, wherein the DOE instantiates a convolution of a symmetrical phase term with an asymmetrical phase term to produce a substantially symmetric beam profile in the plane of the target; and a chuck on which the target is to be mounted, wherein: the focal lens is situated between the DOE and the chuck in an optical path for the optical beam; the optical beam incident upon the DOE is substantially Gaussian; and cross-sections of the DOE that are perpendicular to a radial axis of the optical beam are substantially wedge-shaped.

10. A beam-shaping method, comprising: phase-modulating an optical beam using a diffractive optical element (DOE) that produces a substantially symmetric beam profile in the plane of the target by instantiating a convolution of a symmetrical phase term with an asymmetrical phase term; and focusing the optical beam onto a target at an oblique angle of incidence; wherein the optical beam as phase-modulated and focused onto the target at the oblique angle of incidence has a substantially flattened top in the plane of the target.

11. The method of claim 10, wherein: the phase-modulating is performed before the focusing, using the DOE; and the method further comprises providing the optical beam to the DOE, wherein the optical beam as provided to the DOE is substantially Gaussian.

12. The method of claim 10, wherein: the DOE is shaped to produce respective beam profiles with distinct phases for distinct slices of the DOE, the distinct slices being perpendicular to a plane of incidence of the optical beam; and the distinct phases combine to smooth out spikes in the top of the beam.

13. A beam shaper for an optical inspection tool, comprising: a focal lens to focus an optical beam onto a target at an oblique angle of incidence; and a phase modulator, positioned off-center with respect to the optical axis, to substantially flatten a top of the optical beam in the plane of the target when the optical beam is focused onto the target at the oblique angle of incidence; wherein the phase modulator comprises an element selected from the group consisting of an aspherical lens, a rod lens, and a Powell lens.

14. The beam shaper of claim 13, wherein the element is the aspherical lens.

15. The beam shaper of claim 13, wherein the element is the rod lens or the Powell lens.