Claims

1. A method of cutting a semiconductor wafer, comprising the steps of:

a) providing a laser-cutting apparatus comprising:

a laser source for emitting a laser beam, an optical guide system for receiving the laser beam and directing laser light to an irradiation region of the laser cutting apparatus, a selectively actuatable optical polarizing component for switching a polarization state of the laser light directed to the irradiation region between a first polarization state and a second, different, polarization state; and a support for supporting a semiconductor wafer, and a drive for relatively moving the semiconductor wafer and the irradiation region such that the irradiation region follows a cut line of the semiconductor wafer;

b) supporting the semiconductor wafer within the laser cutting apparatus such that the irradiation region is coincident with a point on a cut line of the semiconductor wafer, and

c) irradiating the irradiation region of the semiconductor wafer with laser light having a first polarization state, and subsequently irradiating the same irradiation region of the semiconductor wafer with laser light having a second polarization state, the second polarization state being different from the first polarization state, wherein the first and second polarization states each comprise one of the group consisting of: linear polarization perpendicular to the direction of relative movement, linear polarization parallel to the direction of relative movement, circular polarization, elliptical polarization and non-polarization;

the method further comprising the step of:

d) relatively moving the semiconductor wafer and the irradiation region in a direction parallel to the plane of the semiconductor wafer such that the irradiation region follows the cut line of the wafer, so that the semiconductor wafer is cut along the cut line.

2. The method of claim 1, wherein the laser source produces a laser beam which is directed to the irradiation region,

step d) is performed while the semiconductor wafer is irradiated with the laser beam having the first polarization state,

the laser beam is then changed to the second polarization state, and then

step d) is repeated while the semiconductor wafer is irradiated with laser beam having the second polarization state.

3. The method of claim 2, wherein step d) is repeated at least once.

4. The method of any preceding claim, wherein the laser source produces an array of laser beams, each laser beam of the array being directed to a different respective part of the irradiation region, and at least a first laser beam of the array has the first polarization state and at least one other laser beam of the array, which trails the first beam in the direction of relative movement, has the second polarization state.

5. The method of any preceding claim, comprising an initial step of determining an optimum polarization state for the laser light to achieve cutting, and
in step c), polarizing the laser light in accordance with the determined optimum polarization state.

6. Apparatus for performing the method of any preceding claim.

7. Laser-cutting apparatus for cutting a semiconductor wafer, comprising:
a laser source for emitting a laser beam;
an optical guide system for receiving the laser beam and directing laser light to an irradiation region;
a selectively actuatable optical polarizing component for switching a polarization state of the laser light directed to the irradiation region between a first polarization state and a second, different, polarization state;
a support for supporting a semiconductor wafer in a position that is at least partially coincident with the irradiation region; and
a drive for relatively moving the semiconductor wafer and the irradiation region such that the irradiation region follows a cut line of the semiconductor wafer such that in use the irradiation region of the semiconductor wafer is irradiated with laser light having the first polarization state, and subsequently the same irradiation region of the semiconductor wafer is irradiated with laser light having the second polarization state;

wherein the first and second polarization states each comprise one of the group consisting of: linear polarization perpendicular to the direction of relative movement along the cut line, linear polarization parallel to the direction of relative movement along the cut line, circular polarization, elliptical polarization and non-polarization.

8. The laser-cutting apparatus of claim 7, wherein the selectively actuatable optical polarizing component comprises a half-wave plate selectively movable for changing linear polarization of the laser beam.

9. The laser-cutting apparatus of claim 7 or claim 8, wherein the selectively actuatable optical polarizing component comprises a quarter-wave plate selectively movable for changing elliptical or circular polarization of the laser beam.

10. The laser-cutting apparatus of any one of claims 7 to 9, wherein the optical guide system comprises a beam splitter for converting the laser beam into an array of output laser beams.

11. The laser-cutting apparatus of claim 10, wherein the selectively actuatable optical polarizing component comprises a plurality of half-wave plates, each being selectively movable for changing linear polarization of a respective output laser beam.

12. The laser-cutting apparatus of claim 10 or claim 11, wherein the selectively actuatable optical polarizing component comprises a plurality of quarter-wave plates, each being selectively movable for changing elliptical or circular polarization of a respective output laser beam.