Claims:

1. A method for depositing a layer on a substrate, comprising:

exposing a surface of the substrate disposed within a processing chamber to a fluid precursor;

directing an electromagnetic radiation generated from a radiation source to a light scanning unit such that the electromagnetic radiation is deflected and scanned across the surface of the substrate upon which a material layer is to be formed; and

initiating a deposition process with the electromagnetic radiation having a wavelength selected for photolytic dissociation of the fluid precursor to deposit the material layer onto the surface of the substrate.

2. The method of claim 1, wherein the radiation source comprises a laser source, a bright light emitting diode (LED) source, or a thermal source.

3. The method of claim 2, wherein the laser source is a fiber laser producing output in the ultraviolet (UV) wavelength range between about 10 nm and about 420 nm.

4. The method of claim 1, wherein the electromagnetic radiation is a pulsed laser beam, a continuous wave (CW) laser beam, or a quasi-CW laser beam.

5. The method of claim 1, wherein the electromagnetic radiation is delivered in a pulsed mode with a pulse duration of about 0.01 microsecond (μsec) to about 100 millisecond (msec) and has an energy density ranging from 0.1 J/cm^2 and about 1.0 J/cm^2.

6. The method of claim 1, wherein the light scanning unit deflects the electromagnetic radiation toward the surface of the substrate in a uniform line beam of about 1 mm to about 5 mm in width and about 320 mm in length.

7. The method of claim 1, wherein the light scanning unit is a rotary polygon mirror having a plurality of reflecting facets.

8. A method for depositing a layer on a substrate, comprising:

flowing a fluid precursor radially across a surface of the substrate disposed within a processing chamber in a laminar manner so that the surface of the substrate is immersed in the fluid precursor;

directing an electromagnetic radiation generated from a radiation source to a light scanning unit such that the electromagnetic radiation is deflected and scanned, in a predetermined shape of illumination, across the substrate at or near the surface upon which a material layer is to be formed; and

initiating a deposition process with the electromagnetic radiation having a wavelength selected for photolytic dissociation of the fluid precursor to deposit the material layer onto the surface of the substrate.

9. The method of claim 8, wherein the radiation source comprises a laser source, a bright light emitting diode (LED) source, or a thermal source.

10. The method of claim 8, wherein the electromagnetic radiation is a pulsed laser beam, a continuous wave (CW) laser beam, or a quasi-CW laser beam.

11. The method of claim 8, wherein the electromagnetic radiation is delivered in a pulsed mode with a pulse duration of about 0.01 microsecond (μsec) to about 100 millisecond (msec) and an energy density ranging from 0.1 J/cm^2 and about 1.0 J/cm^2.

12. A substrate processing chamber, comprising:

a substrate support for supporting a substrate within the processing chamber;

a gas supply providing a fluid precursor into the processing chamber; and

a radiation source emitting an electromagnetic radiation to the fluid precursor at or near a surface of the substrate, the electromagnetic radiation having a wavelength and a power level selected for photolytic dissociation of the fluid precursor to deposit a material layer onto the surface of the substrate.

13. The substrate processing chamber of claim 12, wherein the radiation source comprises a laser source, a bright light emitting diode (LED) source, or a thermal source.

14. The substrate processing chamber of claim 12, further comprising:

a light scanning unit, the light scanning unit directs the electromagnetic radiation from the radiation source to scan across the surface of the substrate.

15. The substrate processing chamber of claim 12, further comprising:

an optical component disposed along an optical path between the radiation source and the substrate, the optical component shapes the electromagnetic energy and project out a line beam in a desired shape that is sufficiently to cover a portion or the entire surface of the substrate.

Claims

1. A method for depositing a layer on a substrate, comprising:

exposing a surface of the substrate disposed within a processing chamber to a fluid precursor;

directing an electromagnetic radiation generated from a radiation source to a rotary scanning unit such that the electromagnetic radiation is deflected and scanned across the surface of the substrate upon which a material layer is to be deposited; and

initiating a deposition process with the electromagnetic radiation having a wavelength selected for photolytic dissociation of the fluid precursor to deposit the material layer onto the surface of the substrate.

2. The method of claim 1, wherein the radiation source comprises a laser source, a bright light emitting diode (LED) source, or a thermal source.

3. The method of claim 2, wherein the laser source is a fiber laser producing output in the ultraviolet (UV) wavelength range between about 10 nm and about 420 nm.

4. The method of claim 1, wherein the electromagnetic radiation is a pulsed laser beam, a continuous wave (CW) laser beam, or a quasi-CW laser beam.

5. The method of claim 1, wherein the electromagnetic radiation is delivered in a pulsed mode with a pulse duration of about 0.01 microsecond (μsec) to about 100 millisecond (msec) and has an energy density ranging from 0.1 J/cm^2 and about 1.0 J/cm^2.

6. The method of claim 1, wherein the rotary scanning unit deflects the electromagnetic radiation toward the surface of the substrate in a uniform line beam of about 1 mm to about 5 mm in width and about 320 mm in length.

7. The method of claim 1, wherein the rotary scanning unit is a polygon mirror having a plurality of reflecting facets.

8. A method for depositing a layer on a substrate, comprising:

flowing a fluid precursor radially across a surface of the substrate disposed within a processing chamber in a laminar manner so that the surface of the substrate is immersed in the fluid precursor;

directing an electromagnetic radiation generated from a radiation source to a rotary scanning unit such that the electromagnetic radiation is deflected and scanned, in a predetermined shape of illumination, across the substrate at or near the surface upon which a material layer is to be deposited; and

initiating a deposition process with the electromagnetic radiation having a wavelength selected for photolytic dissociation of the fluid precursor to deposit the material layer onto the surface of the substrate.

9. The method of claim 8, wherein the radiation source comprises a laser source, a bright light emitting diode (LED) source, or a thermal source.

10. The method of claim 8, wherein the electromagnetic radiation is a pulsed laser beam, a continuous wave (CW) laser beam, or a quasi-CW laser beam.

11. The method of claim 8, wherein the electromagnetic radiation is delivered in a pulsed mode with a pulse duration of about 0.01 microsecond (μsec) to about 100 millisecond (msec) and an energy density ranging from 0.1 J/cm^2 and about 1.0 J/cm^2.

12. A substrate processing chamber, comprising:

a substrate support for supporting a substrate within the processing chamber;

a gas supply providing a fluid precursor into the processing chamber;

a radiation source emitting an electromagnetic radiation, the electromagnetic radiation having a wavelength and a power level selected for photolytic dissociation of the fluid precursor; and

a rotary scanning unit disposed outside the substrate processing chamber, wherein the rotary scanning unit directs the electromagnetic radiation from the radiation source to scan across the surface of the substrate.

13. The substrate processing chamber of claim 12, wherein the radiation source comprises a laser source, a bright light emitting diode (LED) source, or a thermal source.

14. The substrate processing chamber of claim 12,

wherein the rotary scanning unit is a polygon mirror having a plurality of reflecting facets.

15. The substrate processing chamber of claim 12, further comprising:

an optical component disposed along an optical path between the rotary scanning unit and the substrate, wherein the optical component shapes the electromagnetic energy and projects out a line beam in a desired shape that is sufficiently to cover a portion or the entire surface of the substrate.