CLAIMS

What is claimed is:

1. A thin beam laser crystallization apparatus for selectively melting a film deposited on a substrate, the apparatus comprising:

a laser source producing a pulsed laser output beam, the source having an oscillator comprising a convex reflector and a plano output coupler; and

an optical arrangement focusing the beam in a first axis and spatially expanding the beam in a second axis to produce a line beam for interaction with the film.

2. An apparatus as recited in claim 1 wherein the convex reflector is cylindrical defining a cylinder axis, the reflector is positioned with the axis parallel to a first beam dimension, the first beam dimension corresponding to the first axis.

3. An apparatus as recited in claim 1 wherein the laser source further comprises an amplifier.

4. An apparatus as recited in claim 3 wherein the laser source further comprises an optic converging an output beam from the oscillator for input into the amplifier.

5. An apparatus as recited in claim 4 wherein the optic is a lens.

6. An apparatus as recited in claim 1 further comprising a beam mixer.

7. An apparatus as recited in claim 1 further comprising a temporal pulse stretcher.

8. An apparatus as recited in claim 1 wherein the oscillator is an excimer gas discharge oscillator.

9. An apparatus as recited in claim 1 wherein the convex reflector is spaced from the plano output coupler by a distance, L, the convex reflector has a radius of curvature, r, and the ratio r / L is in the range of 0.5 to 5.

10. An apparatus as recited in claim 1 wherein the distance, L is in the range of 1.0m to 2.0m and the radius of curvature, r is in the range of 2.0m to 3.0m.

11. An apparatus as recited in claim 1 further comprising a polarizer interposed between the reflector and output coupler.

12. A thin beam laser crystallization apparatus for selectively melting a film deposited on a substrate, the apparatus comprising:

a laser source producing a pulsed laser output beam, the source having an oscillator comprising an unstable resonator cavity and producing an oscillator output having a beam width, w, in a first axis and a divergence less than three times diffraction limited for the width, w, in the first axis; and

an optical arrangement expanding the beam in the first axis and focusing the beam in a second axis and spatially to produce a line beam for interaction with the film.

13. An apparatus as recited in claim 12 wherein the oscillator output has a beam width, W, in the second axis and a divergence greater than three times diffraction limited for the width, W, in the second axis.

14. An apparatus as recited in claim 12 wherein the oscillator comprises a convex reflector and a plano output coupler.

15. An apparatus as recited in claim 14 wherein the convex reflector is cylindrical.

16. An apparatus as recited in claim 12 wherein the laser source further comprises an amplifier.

17. An apparatus as recited in claim 16 wherein the laser source further comprises a lens operating on an output beam from the oscillator prior to input into the amplifier.

18. A method for producing a beam having a selected divergence in at least one axis using a pulsed, multi-stage laser, said method comprising the acts of:

measuring a relationship for a first laser stage between divergence and laser pulse repetition rate over a range of pulse repetition rates;

measuring a relationship for a second laser stage between divergence and laser pulse repetition rate over the range of pulse repetition rates; and

comparing said relationship for the first laser stage with the relationship for a second laser stage to determine a temperature delta and pulse repetition rate to produce the selected divergence, the temperature delta being a difference between an operating temperature setpoint of the first laser stage and an operating temperature setpoint of the second laser stage.

19. A method as recited in claim 18 wherein the comparing act determines a temperature delta and pulse repetition rate to produce a minimum divergence within the of pulse repetition rate range.

20. A method as recited in claim 18 wherein the determined a temperature delta exceeds 5 degrees C.

CLAIMS

What is claimed is:

1. A thin beam laser crystallization apparatus for selectively melting a film deposited on a substrate, the apparatus comprising:

a laser source producing a pulsed laser output beam, the source having an oscillator comprising a convex reflector and a plano output coupler; and

an optical arrangement focusing the beam in a first axis and spatially expanding the beam in a second axis to produce a line beam for interaction with the film.

2. An apparatus as recited in claim 1 wherein the convex reflector is cylindrical defining a cylinder axis, the reflector is positioned with the axis parallel to a first beam dimension, the first beam dimension corresponding to the first axis.

3. An apparatus as recited in claim 1 wherein the laser source further comprises an amplifier.

4. An apparatus as recited in claim 3 wherein the laser source further comprises an optic converging an output beam from the oscillator for input into the amplifier.

5. An apparatus as recited in claim 4 wherein the optic is a lens.

6. An apparatus as recited in claim 1 further comprising a beam mixer.

7. An apparatus as recited in claim 1 further comprising a temporal pulse stretcher.

8. An apparatus as recited in claim 1 wherein the oscillator is an excimer gas discharge oscillator.

9. An apparatus as recited in claim 1 wherein the convex reflector is spaced from the plano output coupler by a distance, L, the convex reflector has a radius of curvature, r, and the ratio r / L is in the range of 0.5 to 5.

10. An apparatus as recited in claim 1 wherein the distance, L is in the range of 1.0m to 2.0m and the radius of curvature, r is in the range of 2.0m to 3.0m.

11. An apparatus as recited in claim 1 further comprising a polarizer interposed between the reflector and output coupler.

12. A thin beam laser crystallization apparatus for selectively melting a film deposited on a substrate, the apparatus comprising:

a laser source producing a pulsed laser output beam, the source having an oscillator comprising an unstable resonator cavity and producing an oscillator output having a beam width, w, in a first axis and a divergence less than three times diffraction limited for the width, w, in the first axis; and

an optical arrangement expanding the beam in the first axis and focusing the beam in a second axis and spatially to produce a line beam for interaction with the film.

13. An apparatus as recited in claim 12 wherein the oscillator output has a beam width, W, in the second axis and a divergence greater than three times diffraction limited for the width, W, in the second axis.

14. An apparatus as recited in claim 12 wherein the oscillator comprises a convex reflector and a plano output coupler.

15. An apparatus as recited in claim 14 wherein the convex reflector is cylindrical.

16. An apparatus as recited in claim 12 wherein the laser source further comprises an amplifier.

17. An apparatus as recited in claim 16 wherein the laser source further comprises a lens operating on an output beam from the oscillator prior to input into the amplifier.

18. A method for producing a beam having a selected divergence in at least one axis using a pulsed, multi-stage laser, said method comprising the acts of: measuring a relationship for a first laser stage between divergence and laser pulse repetition rate over a range of pulse repetition rates;

measuring a relationship for a second laser stage between divergence and laser pulse repetition rate over the range of pulse repetition rates; and

comparing said relationship for the first laser stage with the relationship for a second laser stage to determine a temperature delta and pulse repetition rate to produce the selected divergence, the temperature delta being a difference between an operating temperature setpoint of the first laser stage and an operating temperature setpoint of the second laser stage.

19. A method as recited in claim 18 wherein the comparing act determines a temperature delta and pulse repetition rate to produce a minimum divergence within the of pulse repetition rate range.

20. A method as recited in claim 18 wherein the determined a temperature delta exceeds 5 degrees C.