CLAIMS

1. A method of additive manufacture, the method comprising:

providing a powder bed;

directing a shaped laser beam pulse train including one or more pulses and having a flux greater than 20 kW/cm^2 at a defined two-dimensional region of the powder bed;

melting and fusing powder within the defined two-dimensional region; and

adjusting at least one of the laser beam energy, pulse width, or an area of the defined two-dimensional region in response to a detected area of a halo formed by a preliminary halo test.

2. The method of claim 1, wherein less than 10% by weight of particles of the powder in the powder bed are ejected into areas outside the defined two-dimensional region.

3. The method of claim 1 or claim 2, wherein the shaped laser beam pulse train is provided by a system including an arbitrary pulsed laser source, at least one pre-amplifier, and at least one power amplifier.

4. The method of any preceding claim, wherein the flux is between 20 kW/cm^2 and 10 GW/cm^2 at the powder bed.

5. The method of any preceding claim, wherein the defined two-dimensional region of the powder bed is between 0.000025 cm^2 and 1,000 cm^2.

6. The method of any preceding claim, wherein a thickness of the powder on the powder bed is between at least one of 1- 2000 μm range, a 25-250 μm range, and 50-100 μm range.

7. The method of any preceding claim, further comprising another calibration step that includes adjusting at least one of pulse shape, number of pulses, or pulse peak power as a

function of time in response to the detected area of the halo formed by the preliminary halo test.

8. The method of any preceding claim, further comprising the step of detecting the halo area formed by the preliminary halo test, with a detected radius of the halo being set greater than 50 microns beyond the defined two-dimensional region.

9. The method of any preceding claim, wherein the powder used is <100,000um in diameter using a pulsed laser intensity < 10 GW/cm^2 at the powder bed.

10. The method of any preceding claim, wherein the powder used is <500um in diameter using a pulse intensity > 20 kW/cm^2 at the powder bed.

11. The method of any preceding claim, wherein the laser temporal pulsewidth is between 20 nanoseconds and 100 microseconds.

12. The method of any preceding claim, wherein a laser pulse train is utilized with number of pulses greater than 1.

13. The method of any preceding claim, wherein the laser pulse peak power is adjusted as a function of time.

14. A laser system for two-dimensional printing comprising

a laser pulse signal source;

one or more pre-amplifier modules; and

one or more amplifier modules; and,

an optical isolation device; wherein, the laser system is configurable to execute the method of any of claims 1-13.