CLAIMS

1. A method for laser cladding a substrate, comprising:

providing the substrate;

depositing a first determined variable bead width of a material along a toolpath upon the substrate;

depositing a second adjacent determined variable bead width of a material along the toolpath which overlaps the first determined variable bead width of deposited material;

continuing to deposit a plurality of overlapping predetermined adjacent variable bead widths of a material until a first material layer is complete;

forming a second material layer by depositing a plurality of overlapping predetermined variable bead widths of a material on top of the first material layer; and

continuing to deposit material layers on top of deposited material layers until the cladding is complete;

wherein the variable bead width of the deposited material is controlled by a computer having a plurality of input parameters to maintain an approximately constant percent of bead width overlap.

2. The method of claim 1, wherein each deposited variable bead width of a material in a layer is varied between about 0.2 mm and about 5.0 mm.

3. The method of claim 1, wherein the overlap is maintained between about 10% to about 90 %.

4. The method of claim 1, further comprising:

inputting transfer functions into the computer to control parameters comprising laser power, laser velocity, defocus distance and powder feed rate to obtain an approximate constant bead width overlap ratio.

5. The method of claim 1, further comprising:

ramping down laser power during deposition of a top 3 to 100 layers.

6. The method of claim 1, further comprising:

initially using a higher laser power for a first 2 to 100 deposited powder layers, then ramping power level down for the remaining powder layers.

7. The method of claim 1, wherein each formed variable bead with is varied between about 0.2 mm and about 5.0 mm in a layer.

8. The method of claim 4, wherein the overlap is between about 10% to about 90 %.

9. The method of claim 7, further comprising:

inputting transfer functions into the computer to control parameters comprising laser power, laser velocity, defocus distance and powder feed rate to obtain an approximate constant variable bead width overlap ratio by adjusting the tool path.

10. The laser net shape manufacturing method of claim 7, further comprising:

ramping down laser power during deposition of a top 3 to 100 layers.

CLAIMS:

1. A method for laser cladding a substrate, comprising: providing the substrate; inputting transfer functions into a computer to control parameters comprising laser power, laser velocity, defocus distance and powder feed rate to obtain an approximate constant variable bead width of deposited material and overlap ratio; depositing a first determined variable bead width of a material along a toolpath upon the substrate; depositing a second adjacent determined variable bead width of a material along the toolpath which overlaps the first determined variable bead width of deposited material, wherein the step of depositing the second adjacent determined variable bead width includes varying the laser power to provide varying of the second adjacent determined variable bead width along the tool path such that an overlap between the first determined variable bead width and the second adjacent determined variable bead width is held approximately constant; continuing to deposit a plurality of overlapping predetermined adjacent variable bead widths of a material until a first material layer is complete; forming a second material layer by depositing a plurality of overlapping predetermined variable bead widths of a material on top of the first material layer; and continuing to deposit material layers on top of deposited material layers until the cladding is complete; wherein the variable bead width of the deposited material is controlled by the computer having a plurality of input parameters to maintain the approximately constant percent of bead width overlap; and wherein the laser power is initially a higher laser power for a first 2 to 100 deposited powder layers, then ramped down over the course of depositing the remaining powder layers.

2. The method of claim 1, wherein each deposited variable bead width of a material in a layer is varied between about 0.2 mm and about 5.0 mm.

3. The method of claim 1, wherein the overlap is maintained between about 10% to about 90%.

4. A laser net shape manufacturing or repair method, comprising: providing a substrate; inputting transfer functions into a computer to control parameters comprising laser power, laser velocity, defocus distance and powder feed rate to obtain an approximate constant variable bead width of deposited material and overlap ratio; forming by laser cladding a first determined variable bead width of a material along a toolpath upon the substrate; forming by laser cladding a second adjacent determined variable bead width of a material along the tool path which overlaps the first determined variable bead width, wherein the step of forming the second adjacent determined variable bead width includes varying the laser power to provide varying of the second adjacent determined variable bead width along the tool path such that an overlap between the first determined variable bead width and the second adjacent determined variable bead width is held approximately constant; continuing to deposit overlapping predetermined adjacent variable bead widths of a material until a first powder layer is complete; forming by laser cladding a second powder layer by depositing overlapping predetermined variable bead widths of a material on top of the first powder layer; and continuing to deposit powder layers on top of deposited material layers until the cladding is complete and a net shape article is manufactured or repaired; wherein the variable bead width of the deposited material is controlled by the computer having input parameters to maintain an approximately constant percent of bead width overlap; and wherein the laser power is initially a higher laser power for a first 2 to 100 deposited powder layers, then ramped down over the course of depositing the remaining powder layers.

5. The laser net shape manufacturing method of claim 4, wherein each formed variable bead with is varied between about 0.2 mm and about 5.0 mm in a layer.

6. The laser net shape manufacturing method of claim 4, wherein the overlap is between about 10% to about 90%.

7. A method of repairing a BLISK, compressor blade, turbine blade or turbine component, comprising: providing a damaged BLISK, compressor blade, turbine blade or turbine component; prepping the damaged BLISK, compressor blade, turbine blade or turbine component to form a substrate surface; inputting transfer functions into a computer to control parameters comprising laser power, laser velocity, defocus distance and powder feed rate to obtain an approximate constant variable bead width of deposited material and overlap ratio; depositing a first determined variable bead width of a material along a toolpath upon the substrate surface; depositing a second determined variable bead width of a material along a toolpath that is adjacent the deposited first determined variable bead width of a material and overlaps the first determined variable bead width of the deposited material layer, wherein the step of depositing the second determined variable bead width includes varying the laser power to provide varying of the second determined variable bead width along the tool path such that an overlap between the first determined variable bead width and the second determined variable bead width is held approximately constant; continuing to deposit adjacent overlapping predetermined variable bead widths of a material until a first material layer is complete; forming a second material layer by depositing overlapping predetermined variable bead widths of a material on top of the first material layer; and continuing to deposit material layers on top of deposited material layers until the cladding is complete; wherein the bead width of the deposited material is controlled by the computer having input parameters to maintain an approximate constant percent of variable bead width overlap of adjacent variable bead widths of material; wherein each deposited variable bead with is varied between about 0.2 mm and about 5.0 mm in a layer; and wherein the laser power is initially a higher laser power for a first 2 to 100 deposited powder layers, then ramped down over the course of depositing the remaining powder layers.

8. The method of repairing the BLISK, compressor blade, turbine blade or turbine component of claim 7, wherein the overlap is between about 10% and about 90%.