CLAIMS

1. A nozzle assembly for performing material processing operations with a handheld laser system on a surface of a workpiece, the handheld laser system having a laser source configured to generate laser radiation, a handheld device that guides the laser radiation, and an optical fiber coupling the handheld device to the laser source, the nozzle assembly comprising:

a nozzle configured to deliver the laser radiation to the surface; and

a coupling mechanism that includes

a retaining portion formed on an output end of the handheld device, and

an engagement portion configured to be releasably attachable to the nozzle and engage with the retaining portion.

2. The nozzle assembly of claim 1, wherein the retaining portion is formed on an annular surface of the output end, wherein the annular surface is configured with at least one recess and a ball disposed within the at least one recess, wherein the engagement portion comprises an annular collar, an inner circumferential surface of the annular collar configured with at least one pair of arcuate shaped slots, each slot configured to receive a ball of the at least one recess and ball.

3. The nozzle assembly of claim 2, wherein the pair of arcuate shaped slots includes a first arcuate shaped slot configured to engage with the ball, and a second arcuate shaped slot configured to lock the engagement portion to the retaining portion when the engagement portion is rotated with respect to the retaining portion, wherein the first arcuate shaped slot is sized to be larger than the second arcuate shaped slot.

4. The nozzle assembly of claim 2, wherein the annular collar is configured with an indexing feature that corresponds to an indexing feature positioned on the output end of the handheld device, wherein each of the indexing features are configured as a visible indexing mark.

5. The nozzle assembly of claim 2, wherein the engagement portion further comprises a spring that engages with an inner surface of the engagement portion, wherein the engagement portion comprises an outer ring and an inner ring,

the inner ring configured with the annular collar having the pair of arcuate shaped slots, and

the outer ring configured with the inner surface that engages with the spring, further comprising an O-ring positioned between the outer ring and the inner ring.

6. The nozzle assembly of claim 1, wherein the coupling mechanism is configured as a twist-lock mechanism.

7. The nozzle assembly of claim 1, wherein the output end of the handheld device is configured with at least one gas port for supplying gas to the nozzle.

8. The nozzle assembly of claim 7, wherein the nozzle is configured as a cutting nozzle, the cutting nozzle comprising

an outlet for permitting laser radiation and the gas to exit the cutting nozzle, and

a z-axis focal length adjustment mechanism,

wherein the nozzle comprises a nozzle extension having an inlet, an outlet, and a central aperture for permitting laser radiation and the gas to enter the central aperture through the inlet and to exit through the outlet.

9. The nozzle assembly of claim 8, wherein at least a portion of an interior surface of the central aperture of the nozzle extension is configured with a debris shield that restricts passage of debris generated during a material process operation.

10. The nozzle assembly of claim 9, wherein the debris shield comprises threads on the interior surface of the central aperture.

11. The nozzle assembly of claim 9, wherein the nozzle is configured with a protective window and the debris shield inhibits material processing debris from reaching the window.

12. The nozzle assembly of claim 8, wherein the nozzle further comprises an external wire feeding device that attaches to the nozzle extension, the wire feeding device configured to supply wire material to the surface, wherein the external wire feeding device is disposed below the nozzle extension.

13. The nozzle assembly of claim 8, wherein the gas exiting through the outlet of the nozzle extension is a primary source of gas and the nozzle further comprises an external wire feeding and gas device that attaches to the nozzle extension, the external wire feeding and gas device configured to supply wire material and a secondary source of gas to the surface, wherein the external wire feeding and gas device comprises:

a central aperture sized to fit around at least a portion of an outer peripheral wall of the nozzle extension;

a gas inlet coupled to a source of gas;

a gas outlet configured as an annular opening that surrounds the central aperture;

a wire material inlet coupled to a source of wire material; and

a wire material outlet configured to supply the wire material to the surface,

wherein the wire material outlet is disposed below the gas outlet.

14. The nozzle assembly of claim 8, further comprising a gas lens device configured to surround at least a portion of the nozzle extension and at least a portion of a nozzle tip attached to the nozzle extension, the gas lens device having a gas outlet configured as an annular opening that surrounds the nozzle tip.

15. A method for performing material processing operations with a handheld laser system on a surface of a workpiece, the handheld laser system having a laser source configured to generate laser radiation, a handheld device that guides the laser radiation, and an optical fiber coupling the handheld device to the laser source, the method comprising:

providing a coupling mechanism that includes

a retaining portion formed on an output end of the handheld device, and

an engagement portion configured to be releasably attachable to a nozzle and engage with the retaining portion.