Applications Testing

Synrad offers CO₂ laser application testing to Original Equipment Manufacturers (OEM), laser system integrators, material manufacturers, processors, and end users of automated machinery. We are CO₂ laser experts, and understand the parameters that will ensure successful, efficient CO₂ laser processing.

**Determine optimal laser power and wavelength** - Applications Engineers will use the latest high performance CO₂ lasers available from Synrad. Combining a full complement of beam delivery systems with material analysis, Synrad Applications Engineers will determine the optimal laser specifications for your exact application and target material.

**Uncover processing know-how and best practices** - based on your specific requirements, and using actual materials and/or parts, Synrad Application Engineers will conduct tests using multiple laser configurations and settings to determine the best processes to achieve your desired results. A full report will be provided that details processing steps and best practices.

**Investigate new techniques** - we have the added ability to investigate new laser techniques, test new materials for laser-process-ability, and solve laser processing challenges.

All Synrad lasers are designed, engineered, and manufactured in one facility located in Washington state. Having one centralized operation enables our entire team to work closely with one another. Applications Engineers work closely with our Design and Production Engineers to quickly solve challenges. This unique ability is invaluable for our customers; questions are answered quickly and challenges are met with hands-on tested solutions.

**In-Person Application Testing** - direct participation in the applications test is available at any regional Synrad Applications Lab. Direct participation is encouraged for new processing systems and/or applications. The advantage being real-time interaction that can result in faster, more efficient communication and alternative problem solving.
Basic Laser Processing System Components

Synrad manufactures high performance CO₂ lasers, often referred to as the source or tube by industry pros. In addition to the laser, several components are required for a complete laser processing system. Synrad does not offer all of these components directly, however you can find a list of popular brands that are compatible with Synrad's high performance CO₂ lasers on our website: https://www.synrad.com/resources/general_information/laser-resources.

Diagram illustrates a CO₂ laser and scan head system.

Laser

Work Piece Delivery System

Vision Inspection

Camera

Fume Filtration & Extraction

Chiller

Power Supply

Safety Zone - Interlocks and Enclosures

Beam Delivery

PLC Controller

Pros

Reliable...Precise...Fast

Cons

For more information visit: https://www.synrad.com/resources/general_information/basic_laser_processing_systems

System Configurations

While there are many possible laser processing system variations, most fall into one or a combination of these four basic configurations:

1. Move the Laser

The laser and beam delivery system is mounted on a computer controlled XYZ table, or robotic arm positions the target material. Typically used for cutting applications where higher laser powers and large processing areas are required.

Pros - allows small focused spot size over a large area.

Cons - challenging optical setup, requires collimation and alignment.

2. Move the Laser Beam

The laser and beam delivery system is fix mounted, and uses galvanometer driven mirrors to steer the beam across the material.

Typical applications - high speed processing lines, where the target material passes in front of the laser beam in a continuous flow.

Pros - fastest beam delivery.

Cons - typically smaller field of view.

3. Move the Material

The laser and beam delivery system is fix mounted, a computer controls the XYZ-table or robotic arm positions the target material under the beam.

Typical applications - popular with batch processing systems, and sitting or perforating roll stock for converting and packaging industries.

Pros - simplest optical setup, processing speeds can be scaled with laser power; allows coaxial air assist.

Cons - applications may be limited based on parts handling/ delivery.

4. Move the Optics

The laser is fix mounted and uses “flying optics” (a series of moving mirrors), to direct the beam over a stationary work surface.

Typical applications - primarily used in the laser is too large or heavy for the gantry or robotic arm. Often found in industrial cutting applications where higher laser powers and large processing areas are required.

Pros - allows small focused spot size over a large area.

Cons - typically slower processing due to weight on the gantry.

Pros

- fastest beam delivery.

Cons

- typically smaller field of view.

Easy optical setup due to consistent path length. Also allows coaxial air assist to improve cut quality and remove debris.

Pros

- allows small focused spot size over a large area.

Cons

- challenging optical setup, requires collimation and alignment.

Laser beam delivery systems focus the raw laser beam onto the target material being processed. There are multiple methods of beam delivery (see descriptions in right column), and selecting the optimal beam delivery system is dependent on target material, work piece delivery, application requirements, and throughput speed. Synrad high performance CO₂ lasers are compatible with a wide range of available beam delivery systems, and have been integrated into numerous custom designed processing systems.

Synrad also offers a line of galvanometer-based scan heads that are perfectly matched with its lasers. Synrad Scan Heads are available in pre-aligned mounting kits that include the laser, scan head, mounting rail kit (base plate), matching power supply, and WinMark Pro process control software. All components are factory pre-aligned using dowel pins to enable setup and perfect optical alignment in just a few minutes, significantly reducing set-up time.

Power Supplies

All Synrad lasers require a well-regulated DC power supply for operation. Synrad offers a matching DC power supply for few key factors - ambient temperature, cleanliness of the operating environment, and laser power. Maintaining the recommended operating temperature of the laser is key to performance and longevity of the laser. Operating environments where the ambient temperature is high will have an impact on the temperature of the laser, and additional cooling components may be necessary. Higher power CO₂ lasers (> 100 Watts) require water cooling.

Work Piece Delivery Systems & PLC Controllers

Work piece delivery systems compatible with laser processing include a wide variety of options, stretching from manual, single-piece-flow units, to fully automated high-speed production lines. These delivery systems are highly configurable, and often customized to fit specific processing applications. Customized systems typically involve specialized engineering services to design and deploy PLC controllers for precision motor, drives, and motion control systems in concert with highly precise laser processors.

Vision Inspection Systems

The integration of visual inspection systems into automated laser marking and coding systems is quickly gaining popularity among automated process system builders. The visual inspections verify marks and codes applied to a multitude of products, ensuring proper application and read-ability. High speed cameras used for this purpose are available from an ever increasing number of manufacturers.

Safety Equipment

Lasers are powerful tools, easily cutting through a wide variety of materials, but can potentially cause serious injury to the human body. Synrad lasers are CDRH hazard classified as Class IV, the highest hazard level. By fully enclosing the laser system, the CDRH hazard classification can drop to Class I, the lowest level. In the diagram on the left, the area highlighted by the dotted line identifies the area of the laser that must be protected from human contact using interlocks and/or enclosures.

Chillers

All Synrad lasers require some method of cooling to ensure optimal performance. Synrad offers both air-cooled and water-cooled options. Selecting the right cooling option depends on a few key factors - ambient temperature, cleanliness of the operating environment, and laser power. Maintaining the recommended operating temperature of the laser is key to performance and longevity of the laser. Operating environments where the ambient temperature is high will have an impact on the temperature of the laser, and additional cooling components may be necessary. Higher power CO₂ lasers (> 100 Watts) require water cooling.

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