

When considering introducing laser technology into your manufacturing process, be sure to marry the right laser to the application being performed.

Lasers have become a common tool in some manufacturing applications. Almost any sheet metal fabricator has at least one CO₂ laser cutting flat sheet, for example. But applications such as welding, heat treating, and cladding of gears and other powertrain parts are just getting started. Except for high-volume automotive applications, there are currently very few production powertrain applications. The major reason is that, compared to welding, laser cutting is a very straightforward application, with all metals being cut with just a few standard process settings, and the parts don't need to be designed for laser processing. Laser cutting system manufacturers can build one system that will handle 90 percent of applications. Welding, heat treating, and cladding are all part-specific, and the part usually needs to be specifically designed to take full advantage of laser processing. The metallurgy is very important, and the laser process usually needs some tailoring for each design. As a result there are no universal systems in these three areas, so to be successful the customer must acquire additional laser application knowledge.

The companies that will succeed in implementing laser processing must be ready to learn, and the amount of knowledge to be assimilated is substantial. It's not hard to get started making a good product, but a true understanding requires learning all the details.

Another challenge is that there's not just one laser for all uses. As I mentioned last month, there are at least eight basic industrial laser designs to be considered—Fast Flow CO₂, Cross Flow CO₂, Diffusion Cooled CO₂, Pulsed YAG, Fiber Delivered YAG, and Fiber, Disc, and Diode lasers—

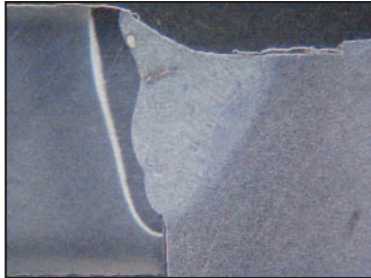


FIGURE 1 Wide weld done by lower quality beam. Used generally for situations such as filling wider gaps, reducing porosity in parts, reducing the necessity for accurate joint location and thin parts,

and each have different beam characteristics. Each laser family also has different initial costs, operating costs, wavelength, beam stability, and beam quality that should be studied in some depth before making a decision. In addition, each manufacturer touts its own technology as the best, so which unit suits your particular application must be considered as well.


First of all, why use a laser? Basically, they can be described as expensive light bulbs that generate a well-focused beam. The beam qualities available vary with different models, but the average 6 kW fast flow CO₂ laser can focus its light into a spot about .008 inches in diameter, and there will be virtually no energy outside a diameter of .012 inches. This provides an energy source that is very intense and well-defined. A laser of this type will have a beam quality intense enough to do a weld .4 inches deep or more by .02 wide.

At this time CO₂ lasers are the most common lasers used for deep welding of powertrain components. CO₂ lasers get their name from the gas that is the active medium that

generates the light. There are typically two other gasses, helium and nitrogen, that are necessary in the gas mix to generate the light. There are three major CO₂ laser configurations at this time: Fast Flow CO₂; Cross Flow CO₂; and Diffusion Cooled CO₂. Each design has its own set of characteristics to consider. Figure 1 shows the shape of a weld from a high beam quality laser compared to one produced by a low-quality beam. In addition, lasers of the same basic design from different manufacturers will have different characteristics.

CO₂ lasers emit light at a wavelength of 10.6 microns, which is in the far infrared electromagnetic spectrum, similar to the wavelength of heat from a fire. There is no practical fiber optic that will transmit this wavelength, thus CO₂ lasers require mirrors to bounce the beam to the work, and special lenses or mirrors to focus the beam.

If you're considering using a laser, there are several things to keep in mind. The most important is to test to see if the laser being considered will reliably make good parts. What seem to be small differences in data sheet performance can make a big difference in the success of your application. Others include: What power level and stability is required? If pulsing is required, what are the pulse characteristics? What mode stability and pointing stability is necessary? What environment will the laser be installed in, and what electrical power is necessary? (Not only voltage, etc., but quality.) What will the maintenance costs be, and what routine maintenance is necessary? If there is a major failure, how quickly can the system be repaired?

Answer these question in advance and you'll be enjoying the benefits of laser technology that much sooner. 

ABOUT THE AUTHOR:

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