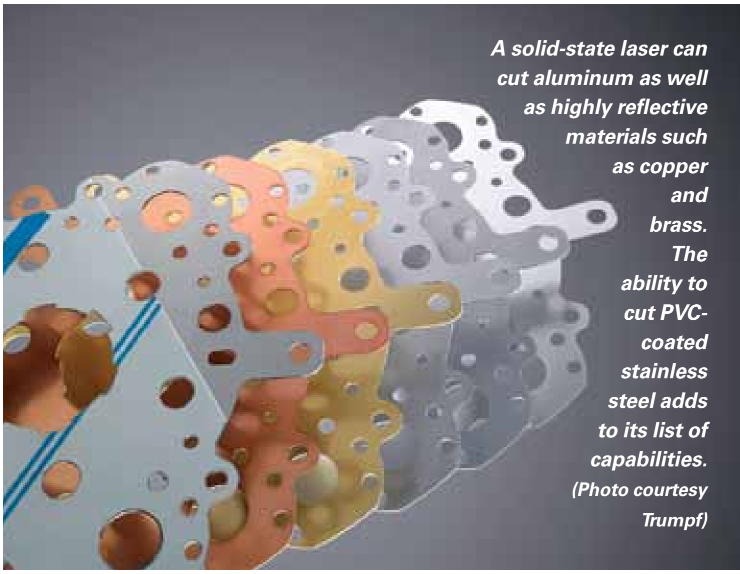
Fiber Lasers:
Three Keys to Optimizing Your Cutting

Solid-state lasers are overtaking CO2 machines as the tool of choice for metal cutting.

Laser cutting has long been accepted as a fast, flexible, efficient and accurate solution for taking an idea from conception to design and to then realize that idea in the form of a sheet metal part. For decades, the preferred resonator source has been the CO2 laser, which produces a truly universal beam for processing a broad range of material thicknesses. Today, however, the solid-state laser is well on its way to overtaking the CO2 as the laser of choice due to its efficient and blisteringly fast processing of thin materials across a broader range of material types.

The good news is if you know how to run a CO2 laser, the transition to a solid-state laser design will be fairly painless. The primary difference is in expectations rather than with parameters on the control. Following are three key differences:

- **Kerf value**—As most fabricators are aware, solid-state lasers can be considerably faster than their CO2 counterparts when processing thin materials. This is mostly due to the considerably higher power density of the solid-state laser. As a result, the actual kerf value (width of material removed by the process) is smaller. This has very little effect when processing thin material, but on mid-thick to thick material performance and quality can suffer. The kerf is so small that the material melted during cutting cannot be ejected as efficiently. To compensate, operators must use higher gas pressures while reducing cutting speeds.



A solid-state laser can cut aluminum as well as highly reflective materials such as copper and brass. The ability to cut PVC-coated stainless steel adds to its list of capabilities. *(Photo courtesy Trumpf)*

That means they must sacrifice performance when moving to thicker materials when using a laser machine equipped with a solid-state laser.

With new technology now available, operators no longer have to make that trade-off. Those equipped with Trumpf's BrightLine fiber technology, for example, give the operator the ability to physically change the beam configuration for processing thick materials. With this adjustability, the performance and quality achieved with the solid-state laser is equal

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A fiber laser results in a smaller kerf, which can present a problem in thicker materials. Technology, such as BrightLine fiber, enables operators to change the beam configuration for thick material processing. *(Photo courtesy Trumpf)*

Trumpf Inc., *Farmington, Conn., offers a range of industrial lasers and metal fabrication machinery. For more information, visit* ***www.us.trumpf.com****.*

Editor's note: *This article was contributed by the experts at Trumpf Inc.*

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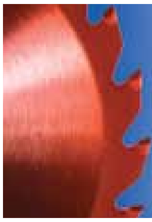
to, if not better than, what is achieved with a CO2 laser, particularly when cutting mild steel.

■ **Increased material range**—Some materials have always been off-limits to laser processing, most notably copper. The reflective nature of materials like copper poses the risk of highly damaging back reflection that could harm the CO2 laser. Traditional fiber laser technology addresses this issue through the superior coupling of the one micron beam with the material, naturally reflecting the beam away. A disk laser design goes even a step further and is completely impervious to back reflection, offering the highest possible level of safety.

For the most part, operators should process copper with oxygen as an assist gas. This will achieve faster cutting speeds and increase protection against back reflections when using traditional fiber lasers. In some scenarios, however, nitrogen is required. This inert gas is necessary for applications when the material's chemical composition cannot be altered. With a traditional fiber laser design, this may be too risky a prospect. With disk laser technology, it is completely safe, although it will be a slower and more expensive processing solution. Operators should be fully aware of the capabilities of their machine and the additional flexibility the technology affords.

■ **Process stability**—Solid-state lasers also simplify the processing of hard-to-cut materials such as aluminum. When cutting aluminum with a CO2 laser, the process has a tendency to generate plasma. If the beam interacts with that plasma, the cut can be lost. Fortunately, there are now systems that can spot that telltale blue light and make adjustments. This alone is a benefit to those processing the material.



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Solid-state lasers rarely cause plasma to form. When it does, the laser beam does not interact with it. Due to this favorable characteristic, cutting aluminum is not only faster with a solid-state laser, it is also easier. For a fabricator, this offers the opportunity to push the boundaries of speed and productivity even further than what's possible with a CO2 laser. Machine operators should not be afraid to play with the speed of the laser to get the ideal combination of quality and processing speed for a given application.

These are just a few examples of what to expect as an owner or operator of a solid-state laser. Luckily, what most have learned through years of experience with a CO2 system won't be for naught. Much of the knowledge gained will translate directly when working with a machine equipped with a solid-state laser, making the transition an easy and productive one. ■