



DIRECT BENEFITS

Direct-diode laser technology offers edge quality comparable to CO₂ and operating advantages similar to fiber

by Abbe Miller, editor-in-chief

For CO₂, one of its final strongholds is the near-mirror edge quality it creates in thicker materials compared to fiber. Fiber, even though it might not produce the same level of edge quality, outperforms CO₂ on nearly every other front. Direct-diode, however, is ready to tackle both technologies.

Its edge cuts in thicker materials are nearly indistinguishable from CO₂ edge cuts and its speed in cutting thinner materials is giving fiber a run for its money. Not to mention direct-diode's wall-plug efficiencies and minimal maintenance requirements, once major differentiators for fiber technology.

New, bright future

Direct-diode lasers aren't new, but until Mazak Optonics Corp. announced its Optiplex DDL machine at Fabtech 2016, they hadn't yet been packaged as turnkey systems.

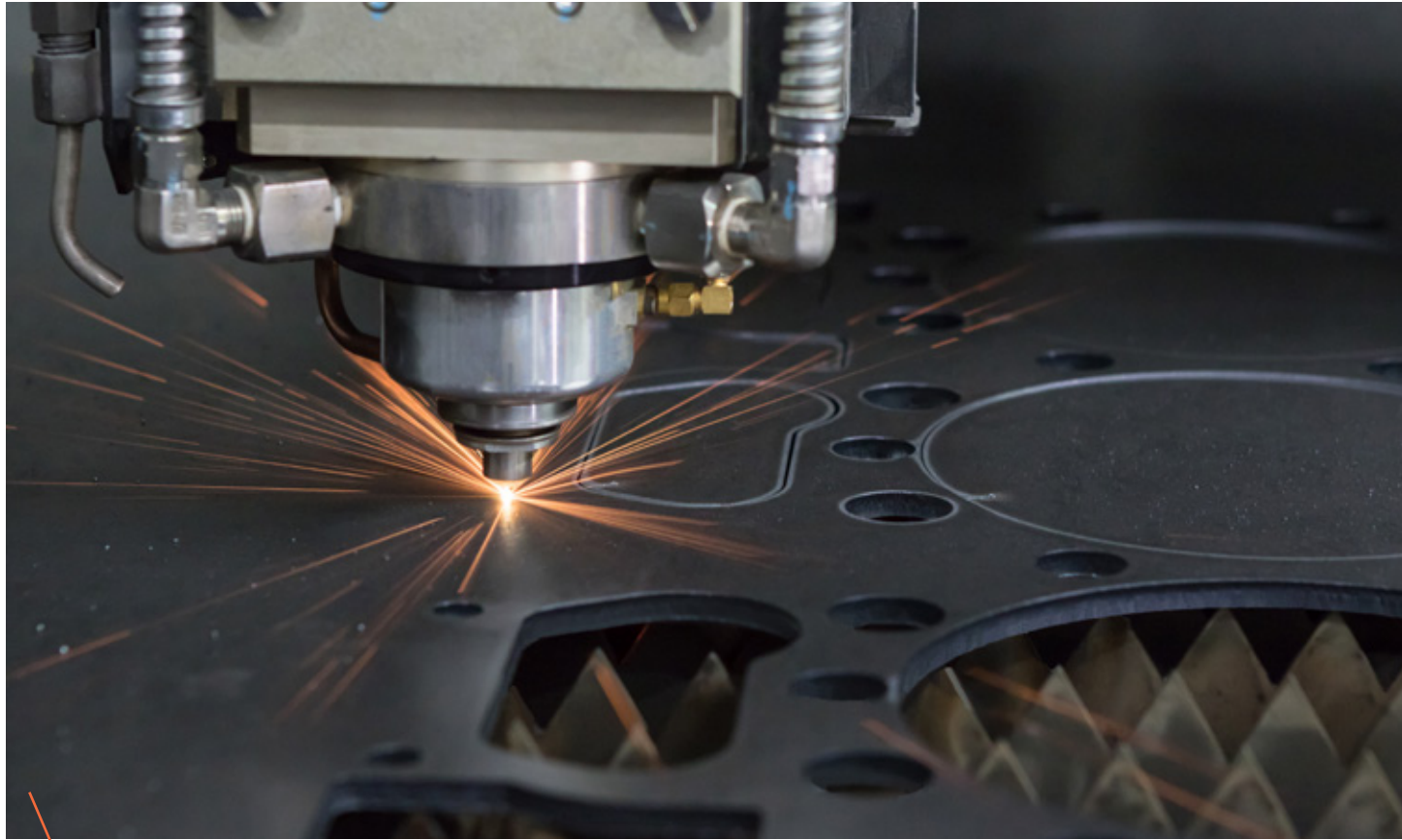
Out of the box, the Optiplex DDL features flying optics, two pallet changer designs and a helical rack-and-pinion positioning system enabling higher cutting speeds. Within the DDL, users will find the benefits of fiber, such →

Industrial fiber laser cutting has absolutely crushed CO₂ laser cutting in terms of market share in the past few years. With its fast processing speeds, low maintenance and high wall-plug efficiency, fiber has basically relegated CO₂ to the land of outdated cutting equipment. Fiber isn't alone, however, in taking market share from CO₂.

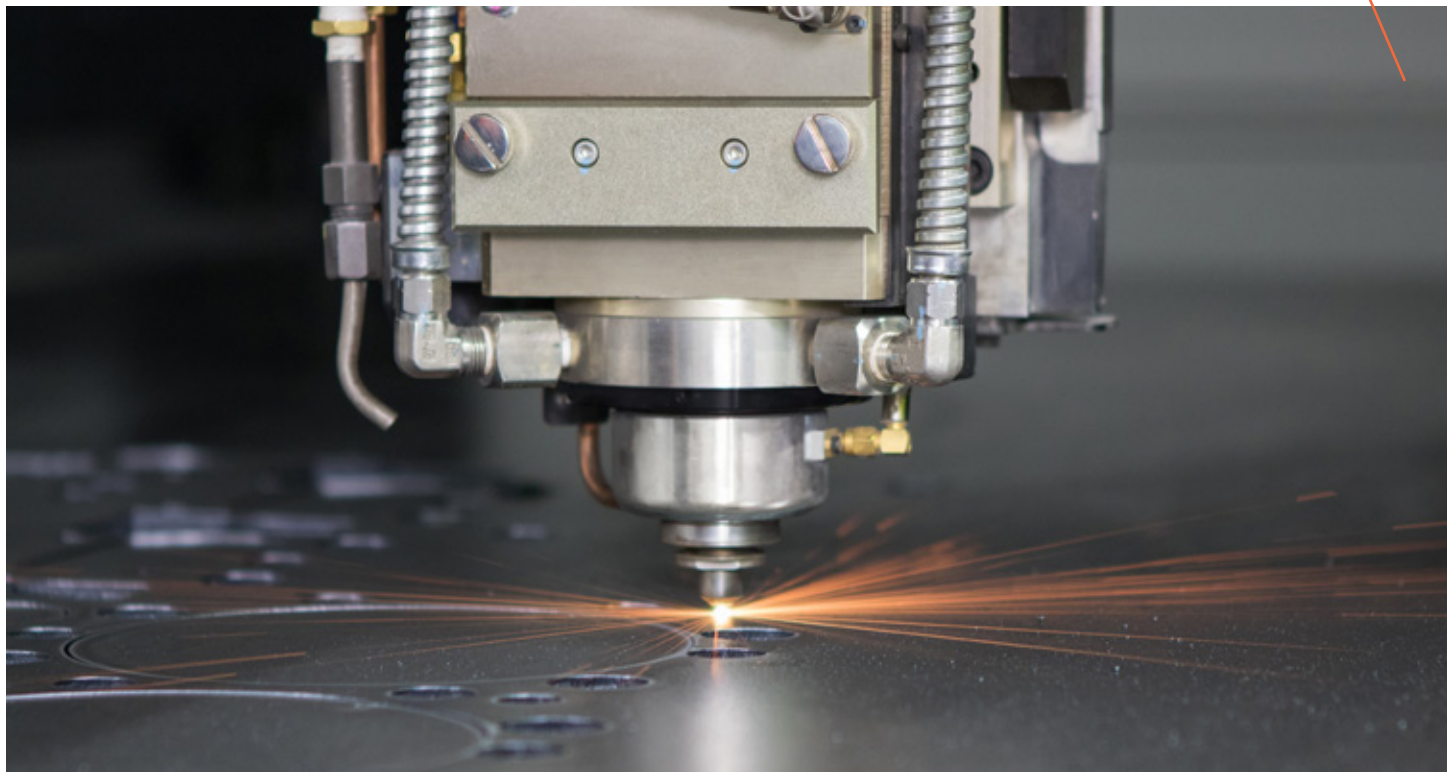
Direct-diode laser cutting, despite being a relative newcomer, might just be the technology to put the final nail in the CO₂ coffin. It's also proving to be a viable contender when put head-to-head with fiber.

Examples of edge quality delivered by the Mazak direct-diode laser. 1-in. mild steel, 3/8-in. mild steel, 5/8-in. stainless steel and 1/2-in. aluminum.





The Mazak Optiplex DDL features Intelligent Multi-Control Torch HP-D and Nozzle Changer technology to optimize torch setup.



as high wall-plug efficiency and low maintenance requirements as well as the superior edge quality that comes with CO₂.

“We’d shown fiber cut parts to plenty of job shops that said that the edge quality wasn’t good enough for their customers,” says Mark Mercurio, Midwest central regional sales manager at Mazak. “Most folks, but especially the thicker plate cutting guys, like those in the agricultural industry, had become accustomed to the smooth finish of a CO₂, and they tended to shy away from thicker fiber cut parts because of it.

“Cuts from fiber were a little bit rougher in the thicker mild steels, but direct-diode technology is now able to achieve the smooth finish those customers had relied on with CO₂,” Mercurio continues. “The guys that were unwilling to switch to a solid-state laser are now considering it with direct-diode technology. They get the benefits of solid state and still get the edge quality that they’re used to.”

Direct-diode technology is able to create faster cutting speeds and high-quality edges thanks to a combination of its

wavelength and laser beam profile. The wavelength of a laser defines how well a laser can be absorbed into the metal. Better absorption results in faster cutting speeds. Additionally, the Optiplex DDL laser beam profile is similar to that of a CO₂ beam. This helps produce an edge quality similar to that of the CO₂.

Historically, with CO₂ and fiber, a gain medium is required to excite the laser to a certain wavelength. With direct-diode lasers, no gain medium is required and virtually any wavelength can be created to address the absorption characteristics of various types of metals. This aids in the production of high-quality edges, but it also plays a big part in the speed that direct-diode is able to achieve.

Cut to the quick

The brightness – or wavelength – produced by direct-diode technology is well-suited for the full range of materials that metal fabricators and manufacturers typically work with. The better a metal can “accept” or “absorb” a certain wavelength, the faster the laser can cut through it. →

Mercurio says that across the materials board, the Optiplex DDL has achieved feed rate increases in the ballpark of 15 to 20 percent. And that's compared to the company's own 4-kW fiber laser.

"The 4-kW fiber laser is a competitive machine, but we're seeing the DDL with the same power level cutting faster than that machine in all materials," he says. "Aluminum is one of the places where you get the benefit of the high end of that 15 to 20 percent range of increases. For mild and stainless steel, brass and copper, the DDL is averaging increases in feed rates at about 15 percent. And that's significant."

In the competitive realm of laser technologies, the increase in speed is turning the heads of fiber laser users. Direct-diode already boasted low maintenance and wall-plug efficiency, leaving speed as one of fiber's only differentiators.

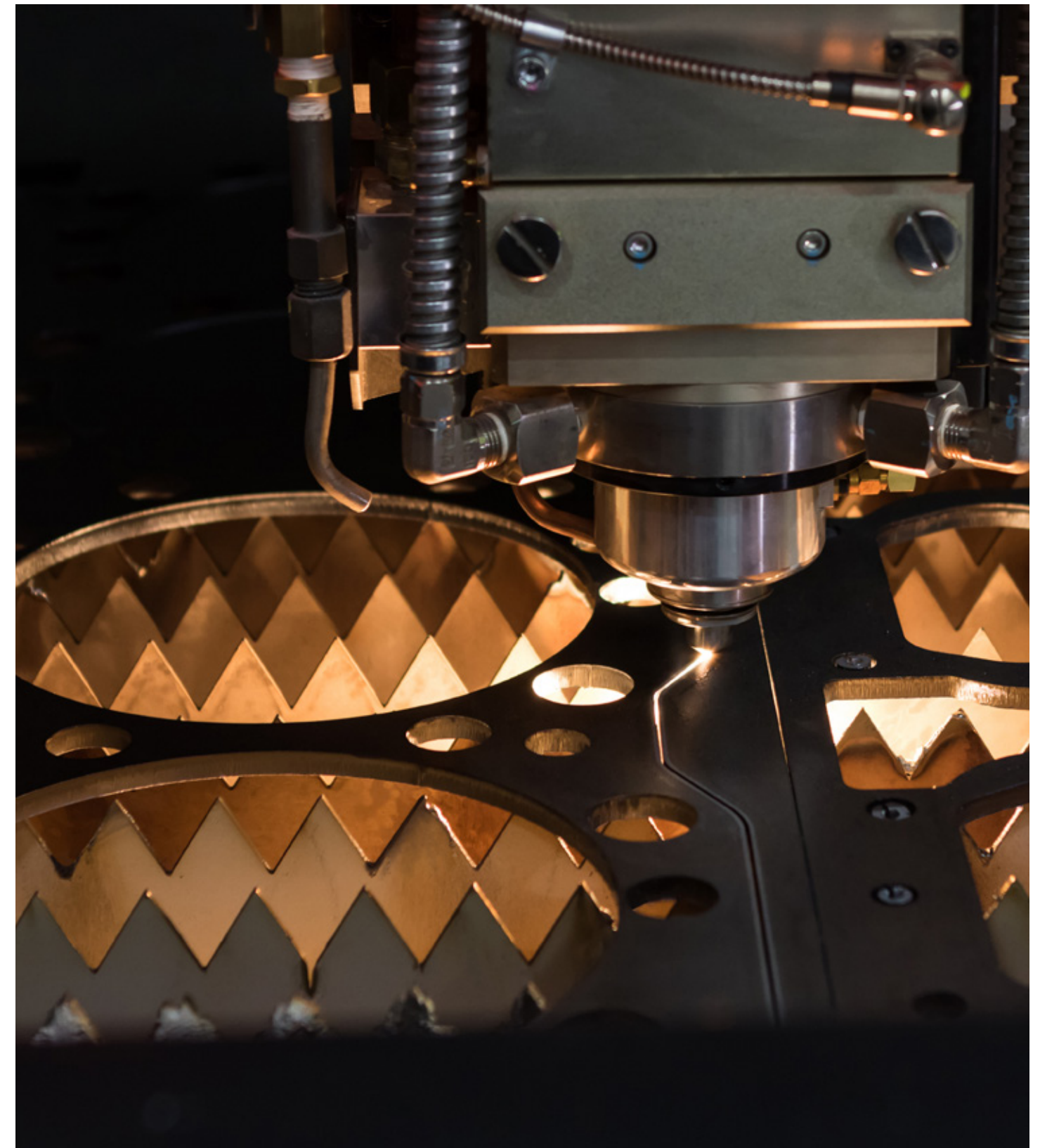
Plugged in

To better understand how and why direct-diode is making such strides in the competitive laser field, Mercurio

offers a quick history lesson on the progression of industrial laser technologies. The amount of electricity required to power a laser cutter has become less demanding throughout the years.

"Lasers have been around since 1986," Mercurio says. "And the first generation laser – a CO₂ laser – only had 10 percent wall-plug efficiency. CO₂ lasers, even today, are very mechanical, so you have to turn on pumps, blowers and chiller units, just to name a few parts, to start cutting. The second generation were the fiber lasers and, as everyone knows, they come with a lot of benefits, including 35 percent wall-plug efficiency.

"The third generation of lasers, direct-diode lasers, can exceed fiber's power efficiencies because no power is required to excite a gain medium," Mercurio continues. "The wall-plug efficiency, therefore, can reach 45 percent. If we don't talk about assist gas, one of the biggest expenses to run a laser is electricity. If you're switching from a 4-kW CO₂ machine to a 4-kW DDL, you're able to replace 100-amp service with 40-amp service." →



The Optiplex DDL delivers fast cutting speeds and high-quality edges due to a combination of its wavelength and laser beam profile.



The new Optiplex DDL serves as a breakthrough laser platform, offering fabricators and manufacturers the utmost in performance and reliability.

Full package

On top of speed, edge quality, wall-plug efficiency and low maintenance, Mercurio says that the Optiplex DDL machine offers a sophisticated interface that's simple for operators to learn and use. It also boasts a robust frame that can sustain the speeds that direct-diode reach.

The Optiplex DDL's Intelligent Multi-Control Torch HP-D and Nozzle Changer technology further increases productivity by automatically

optimizing the torch setup, which improves cutting speeds and increases throughput with minimal operator intervention. Additionally, the entire package is housed in a cast machine, which is standard on all Mazak equipment.

"Mazak is a machining house, so they produce their fabrication machines just as robust as they build their machining centers," Mercurio says. "That cast frame dampens vibration from the shop environment, which

aids in the smoother edge quality. The DDL has higher acceleration rates; the machines are just faster – not only in cutting speeds but pure processing time. The cast frame, therefore, helps us sustain those speeds for longer periods of time."

Furthermore, Mazak is still a family-owned business, so because the owners put their name on the machine, they will accept nothing but the most robust machine possible. Mazak took major care in not rushing to market with the machine. Two years prior, the company announced the development of its VCL, its first direct-diode laser machine for tube and pipe processing.

"When we introduced the VCL, it was a 2-kW machine; we didn't have a 4-kW direct-diode machine yet," Mercurio explains. "The flagship machine that gets purchased in the United States for fiber laser is typically a 4-kW. As that product was maturing, we were testing and running production on the 2-kW and then when the 4-kW was ready, we needed a period of time in our own technology centers and

production facilities to run tests on the 4-kW DDL before we could introduce it into the marketplace."

Now that Mazak's 4-kW DDL machine is on the market and fully vetted by the engineers at the company, users can relish in the benefits previously reserved for CO₂ and fiber lasers. From reduced operator dependency to improved cut quality and increased productivity, direct-diode is a serious contender in terms of taking market share from legacy platforms.

"In the past, two parts would be compared, one would be CO₂ and one would be fiber," Mercurio says. "For edge quality, customers would choose the CO₂, but in that same breath, they'd equally want the benefits that came with fiber. Now, when we compare two parts, one CO₂ and one direct-diode, even an experienced laser operator can't tell the difference, meaning he can finally take advantage of the solid-state benefits." ●

Mazak Optonics Corp. →