*by Abbe Miller, editor-in-chief*

# TRENDING TOPICS

As 2017 lifts off, the industrial laser community looks up to Industry 4.0, additive manufacturing and new laser sources

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A bird's eye view of Fabtech 2016 would reveal just how expansive the metals fabricating market is. Yet, year after year, the big picture is the same: Thousands of attendees, hundreds of booths and a seemingly unending supply of products. To discover what's truly new in the market, the 30,000-ft. view doesn't suffice.

To get a better look at what's shaping the industry in the New Year, the editors at *Shop Floor Lasers* got up close and personal. We spoke to various laser manufacturers at the event and discovered the trends and challenges that are driving change.

With our ear to the ground, we heard that Industry 4.0 will grow in its adoption as will additive manufacturing. We also got insight surrounding new laser sources and their potential in the marketplace.

## Big data developments

When talking about the new developments emerging in the industrial laser space, one might balk at the inclusion of Industry 4.0. The buzzword isn't new and neither are many of the tools being produced to adopt it. What is new, however, is how the proliferation of fiber lasers is essentially forcing fabricators to embrace it.

"The key driver of today's metal fabrication industry can be found in the pace of technological change and the attendant cost savings associated with it," says Bob St. Aubin, president of Bystronic Inc. "With the introduction of the fiber laser and its ever-increasing power output, the metal fabricator is increasingly able to flexibly produce larger volumes of high-quality blanks faster than ever before.

"But, as human operators have been hard pressed to keep up with this higher output, full automation, including robotic part sorting and stacking, has become a requirement to maintain the efficiency of this initial operation," he continues. "As more parts have become available to move through the factory, more efficient technologies in the setup and automation of downstream operations, like forming and welding, have also become critical. However, new technology can only reach its maximum potential when it's monitored and when data is controlled and communicated using the powerful software tools that have become available with the implementation of Industry 4.0."

So as productivity increases with the introduction of new equipment, fabricators are less hesitant to consider Industry 4.0 in their facilities. Initially, some of the barriers to adoption seemed as simple as not fully understanding what Industry 4.0 entails. Stefan Colle, laser product sales manager at LVD Strippit, echoes that sentiment when talking about the strategy moving forward.

"Industry 4.0 isn't a trend; it's reality, and we see it fundamentally changing the way production is handled," he explains. "But, there's still a lot of confusion around Industry 4.0 – what it is, what it means and how to take advantage of the new opportunities it promises. We need to get beyond the terminology to educate customers – large and small fabricators alike – about the real benefits behind Industry 4.0." →

He explains that LVD has espoused Industry 4.0 solutions for some time, introducing products that tie into the overall philosophy. The company's Touch-i4 tablet, as just one example, remotely monitors LVD laser machines, looking constantly at their efficiency and job activities.

To further maximize the benefits that come with Industry 4.0, Colle says that LVD delivers extensive offline programming that can be fully automated with the company's CADMan-Job software. By integrating the software system with the front office and shop floor, users can easily generate and manage jobs all while experiencing increased throughput – a picture perfect example of how Industry 4.0 streamlines the workflow.

A better understanding of why manufacturers and fabricators need Industry 4.0 is the first step to adoption. The second step involves an understanding of the data and insight that can be captured by new systems. Michael Atchley, product line director at nLight Inc. takes the next step behind the scenes to explain how these systems do what is expected of them.

"From our perspective, as power source suppliers, sophisticated tool manufacturers are definitely wanting to push for greater performance," Atchley explains. "We ask the OEMs what their customers are looking for in terms of factory optimization, and we work to provide the appropriate software (APIs) and hardware hooks to enable them."

Today's laser source interfaces and electronics can support the needs of basic fabrication. However, if a fabricator is striving to build a more efficient factory, the discussion must move from "simple hardware interfaces to more value-adding digital and programming options, having processors built into your systems that can communicate with factory automation software," Atchley says.

"We see customers wanting to use the network to know if their fiber laser tool is fully operational, if it is running efficiently and if there are signals triggering an opportunity for →

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preventative maintenance," Atchley continues. "We have found more and more users trying to figure out how to connect their systems for greater value."

For Atchley and the team at nLight, Industry 4.0 places more responsibilities on the equipment manufacturers. No longer are they expected to only execute on laser cutting or welding capabilities; they're expected to help customers gain productivity across the board.

"We've built our products in accordance with the productivity and connectivity customers require in today's marketplace," he says. We recognize the importance of supporting the customer's requirements for greater efficiency and higher uptime."

## The 3-D approach

According to a new report from PricewaterhouseCoopers (PwC), 3-D printing, aka additive manufacturing (AM), "is crossing from a period of hype and experimentation into one of rapid maturation." In years past, the manufacturing industry has kept a close eye on the technology, watching as it progressed from a tool for prototyping to one capable of producing end products. Its progress can be seen via the rise in global spending on both desktop and industrial equipment. In 2015, spending on printers reached $11 billion, and by 2019, according to IDC Research Inc., it's forecasted to hit $27 billion.

"A proliferation of new-entry printer makers are offering faster, cheaper and more sophisticated 3-D printers on both the personal desktop and industrial printer markets," PwC reports. "And, as printers expand the portfolio of inks that can be used – most notably metal, ceramics and graphene – 3-D printing will likely continue its march to compete with conventional manufacturing technologies, especially as the expectations and needs for just-in-time and customized products rise. Quite simply, 3-D printing is becoming mainstreamed."

When looking deeper at the increased applications for AM when producing metal products, Christof Lehner, general manager of the Trumpf Inc. →

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Laser Technology Center, has high hopes.

“Additive manufacturing has received a lot of attention in recent years, and the technologies will only become more exciting as we move forward,” Lehner explains. “In metal printing, we have already seen improvements in build rates, system offerings and usability. As this continues, AM will appeal to an ever-increasing market and eventually, we expect it to become a cornerstone of manufacturing.”

Likewise, Rick Neff, manager market development at Cincinnati Inc., sees a bright future for AM. He prefaces his positive forecast with an explanation for why the technology’s progress has been slow. He chalks up some of the hesitance to misconceptions that have been placed on AM.

“The interesting thing about additive manufacturing is that there’s a lot of hype,” he says. “The industry talks about the hype cycle in that there are different cycles of hype that keep coming and going. The problem is that some people have been given the idea that it’s just for prototyping parts or making small fragile parts. But, the reality is that it can be used for making really good, durable parts.”

AM does have limitations. While he believes that it will grow in adoption, Neff admits replacing conventional methods of machining or laser cutting parts isn’t in the cards for AM.

“If someone is looking at making a sheet metal part, it’s faster and easier to laser cut and then bend it on a press brake instead of trying to 3-D print it,” Neff explains, adding that the cost for 3-D printing can sometimes be prohibitive, as well.

“Additive manufacturing, however, gives us another tool for making things, and it will be worked into the overall way we make things. It will have a role in many manufacturing plants in the future.”

Neff adds that the key factor in adopting 3-D printing lies in applications knowledge. While developments in the technology have been seemingly slow, manufacturers →

and fabricators were simply looking for the right applications to be able to bring the technology on board.

"It's a combination of finding the right application and having the applications knowledge to be able to get consistent productivity and parts out of the machine," he says.

General Electric serves as a good example of how the wait-and-see approach can pay off. An article published by MIT Technology Review says that the company is now making parts for a new aircraft engine leveraging AM. The part quantities and required accuracy and integrity turned out to be a perfect fit for AM when compared to other methods.

"GE chose the additive process for manufacturing the nozzles because it uses less material than conventional techniques," the MIT article explained. "That reduces GE's production costs and, because it makes the parts lighter, yields significant fuel savings for airlines. Conventional techniques would require welding about 20 small pieces together, a labor-intensive process in which a high percentage of the material ends up being scrapped.

"Instead, the part will be built from a bed of cobalt-chromium powder. A computer-controlled laser shoots pinpoint beams onto the bed to melt the metal alloy in the desired areas, creating 20-micrometer-thick layers one by one. The process is a faster way to make complex shapes because the machines can run around the clock. And AM in general conserves material because the printer can handle shapes that eliminate unnecessary bulk and create them without the typical waste."

As adoption swells, companies like nLight are positioning themselves to be a player in the AM space. Atchley says the company is targeting the next generation of AM tools, where the laser source helps differentiate the overall solution. Higher processing speeds, greater part quality and lower processing costs will most likely be the focus of that next generation.

"We still see its primary adoption in high-end aerospace applications as well as in some automotive applications", Atchley says, adding that the technology's current sweet spot lies in what he describes as lower-volume, higher-mix projects. "We're also seeing some interesting things with multiple laser sources working together in a common tool. There are definitely a few trends that are helping to push the technology to greater adoption."

So while some companies are still in a holding pattern before jumping onto the 3-D wave, the technology has definitely made a home for itself in the metals fabricating industry. For now, high-end, high-tolerance production settings are where most benefits will be found.

## Source of interest

For some – if not many – in the fabricating industry, the physics that drive laser processing is hard to comprehend. Fortunately, reaping the benefits of laser technologies doesn't require a degree in physics. Also fortunate is the constant expansion of how lasers are used in →

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fabricating operations. Like each year before it, 2017 is delivering a new wave of developments in laser processing, including direct-diode technology among others.

"Examples of this trend are the deployment of the tri-focal laser in the automotive industry, which delivers three individual beams to the workpiece, and the wobble head now fully deployed in numerous welding applications, including joining of dissimilar metals," says Bryce Samson, director of sales North America at IPG Photonics. "These are examples of the trend toward offering a more tailored solution to the problems industry is facing."

To bring additional solutions to laser users, Mazak Optonics Corp. used the Fabtech 2014 stage to unveil a new tube laser cutting machine. With direct-diode laser technology at the heart of the machine, attention for the VCL Tube Laser was high. Two years later, Mazak is experiencing the same level of interest in yet another machine grounded in direct-diode laser (DDL) technology. The company's Optiplex DDL, introduced at Fabtech Las Vegas, marks a new wave of laser sources emerging in the marketplace.

There are several areas where DDL has made advancements over $CO_2$, fiber and disk lasers – the first is the energy efficiency of the laser. For decades, $CO_2$ ruled the roost, but as most fabricators know, fiber has unseated $CO_2$ as the go-to laser cutting technology. To determine DDL's role moving forward, one must start by looking at the benefits it brings to the cutting table. In addition to the energy efficiency, edge quality is another area that the laser technology will excel in.

"Cut performance is notably improved with DDL technology as the wavelength and beam shape characteristics are different than fiber and disk lasers," says Al Bohlen, president at Mazak. "These characteristics deliver a much superior edge quality not yet seen on fiber and disk lasers and at speeds that, in many cases, are faster."

As a company that has established itself as first to market with DDL →

sources, Mazak continues to invest in proprietary technology. Plans for the future include expanding power levels and offerings in all ranges of the company's products.

Trumpf's Lehner agrees that DDL is an exciting technology coming onto the scene. He says, however, that fiber lasers will still remain on top in terms of overall laser cutting capabilities.

"Direct-diode technology is rapidly improving and will soon be the laser of choice in many applications," he says. "Short wavelengths, high brightness in compact packages at competitive cost will further increase the attractiveness of laser applications. However, we also know there is never just one choice when it comes to laser processing."

LVD Strippit's Colle doubles down on that sentiment.

"At this point, there are no signs or real evidence of a 'one micrometer wavelength laser' that will cause DDL or any other technology to become the laser source of choice over the fiber laser technology LVD is currently employing," Colle says. "In fact, the quality and efficiencies of fiber laser technology continue to evolve and this makes us believe we have not yet reached the pinnacle of fiber's capabilities."

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Working off of the idea that DDL is a cost-effective method for various laser processing applications, nLIGHT's Atchley says that the most successful metal fabricators and manufacturers will have the complete portfolio of laser sources, causing fiber and DDL to stand side by side on the manufacturing floor. Panasonic's investment in newly-acquired TeraDiode underscores the confidence that many have for the relatively new laser source.

"The key is having an appreciation for which laser technology should be used for what applications," says Atchley. "We all understand that CO2 used to be the workhorse for metal cutting and that fiber lasers have largely displaced them due to advantages in speed and efficiency. Fiber laser sources have a big advantage in terms of optical brightness. With that said, the power consumption of DDL sources leads it to be attractive for low brightness applications like cladding and hardening."

As is true with any new technology, fabricators will need to understand the benefits and limitations and how they play into their specific application needs. Atchley says this has been the case with pico-second lasers, diode-pumped lasers, disk lasers, CO2 lasers and other types of gas lasers.

"There are numerous pros and cons for different laser sources," Atchley says. "You get good mode quality with fiber, and it allows you to power scale to high powers reliably. And those benefits work well, not only in terms of the price for a processed part, but also for the exceptional uptime you can expect from a fiber laser source."

Until new materials come onto the scene that might call for a new or different laser source, fiber is here to stay. For many, direct-diode's complementary role to fiber is a comforting position for it to take, considering how many companies have already invested in fiber or are on the cusp of investing in it. ●

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