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Automation is expected to drive use of laser welding in markets like automotive.

Core strength

Fiber optic technology equips fiber laser machines for mass production applications in multiple markets

A car engine converts gasoline to motion but it's the distributor cap that brings the vehicle to life by transferring high voltage from the ignition coil to the spark plugs. The traditional distributor has since given way to an electronic ignition mechanism followed by automakers' newest development, the distributor-less ignition system.

So too have fiber lasers evolved thanks to advances in the fiber optics technology that drives them. The rapid industrialization and adoption of fiber lasers over the last decade is largely due to physicist Valentin Gapontsev, who pioneered the development of fiber optic technology.

"My dream is to see lasers—like computers—become a tool of choice in mass production, rather than being viewed as a last resort in many applications," he said. Gapontsev founded IPG Photonics Corp. in Russia in 1991. The company received its first major contract from telecommunications carrier Italtel and earned a second contract from DaimlerBenz Aerospace, prompting the opening of a facility in Germany in 1994. In 1998, IPG established its world headquarters in Worcester, Massachusetts. In 2000, the company built new high-capacity production facilities to manufacture its own diode pumps, a key component of its fiber lasers and amplifiers.

IPG's Wobble and Seam Tracking welding head adaptor ensures consistency in difficult to join materials.

Five years later, the company went public.

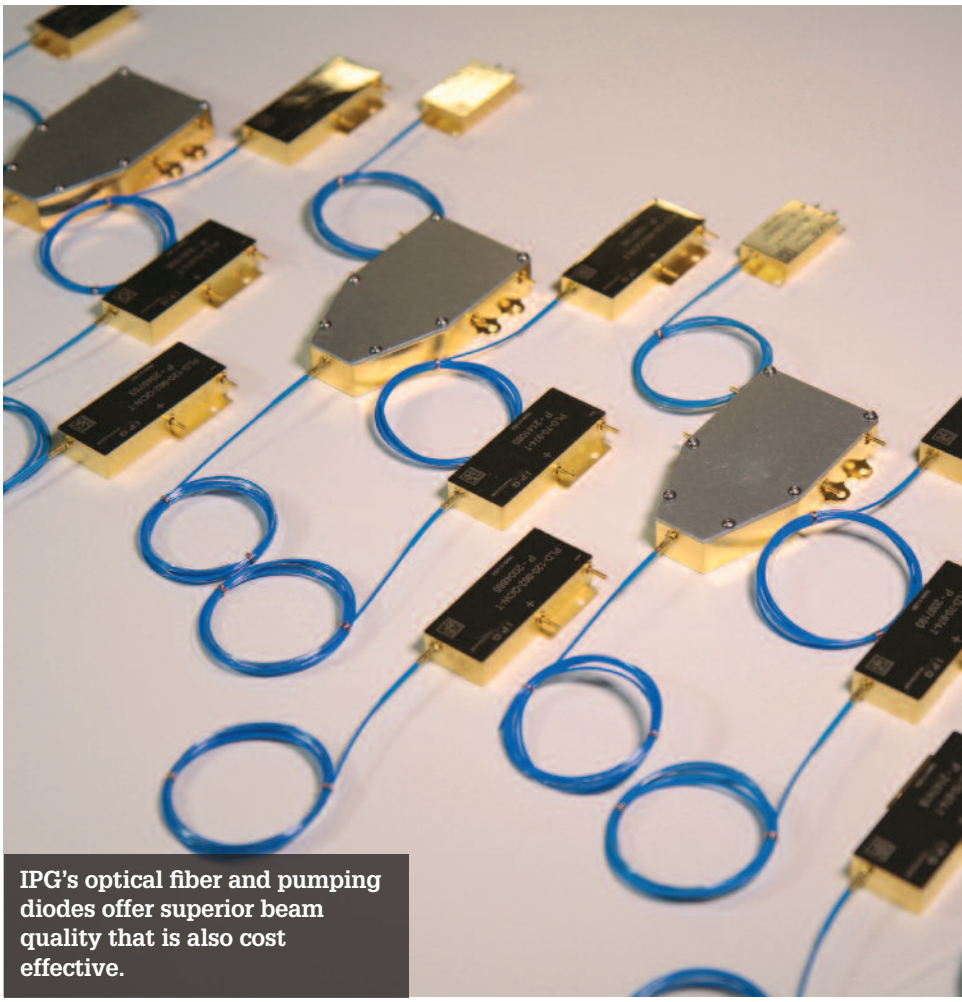
Today, IPG supplies fiber laser machine builders with a complete package of optical beam delivery components ranging from fiber and optics, beam couplers and switches to processing heads, collimators (a device that narrows a beam of particles or waves), process control and tooling options.

Quick step

"The trend within the cutting market segment has been to use higher power, cut faster and cut thicker material," says Bryce Samson, North American director of sales for IPG. "To accommodate these demands, fiber laser machines must have the power source yet be able to deliver good cut quality with increasingly thicker materials. Our job is to provide fiber optics technology at cost-efficient price points."

Samson says machinery makers are marrying IPG's power source with their own hardware and software. "As a result, we saw fiber laser machines at Fabtech 2017 with capabilities that were not available three years ago."

In many cases, manufacturers are now choosing fiber laser equipment over plasma and waterjet machines to cut materials for automotive components and a myriad of other parts for diverse applications. But the adoption of fiber lasers outside the material cutting space is far from mature. "We feel laser welding and brazing [joining of metals] are the next markets showing the most promise for growth," Samson says. "The automotive market has been an early adopter of laser welding on its product lines because it's a good fit for automated robotic systems."



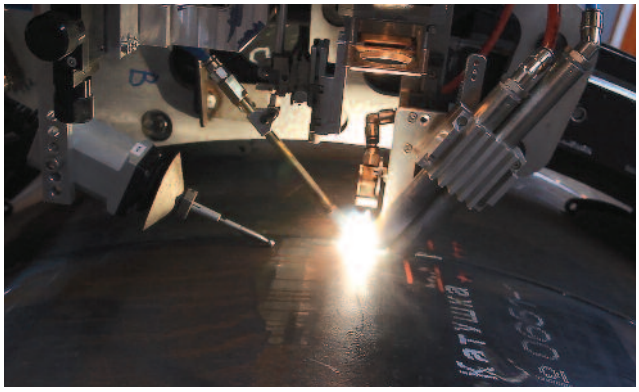
IPG's optical fiber and pumping diodes offer superior beam quality that is also cost effective.

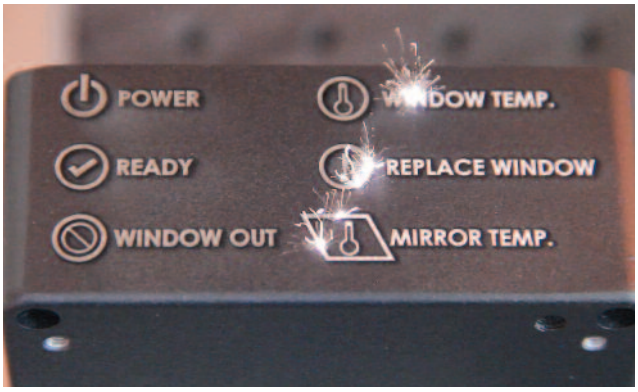
> "As automation becomes more economical and robots became easier to program, we expect to see use of laser welding rise."
>
> **Bryce Sampson**, IPG Photonics

The reason, he explains, is that carmakers "have the ability to design parts for a particular process," a trait that is often a roadblock for industries that don't have the design freedom to rework a part for technologies like laser welding. "As automation becomes more mainstream and thereby more economical, and robots become easier to program, we expect to see use of laser welding rise," Samson says. "Our job is to have the technology available."

Wobble and seam

IPG's Wobble and Seam Tracking welding head adaptor gives fabricators the ability to





achieve consistent results with shiny materials like aluminum, copper and titanium, which are prone to back reflection. Conventional welding of process-sensitive materials can result in defects like pore formation and thermal cracking.

With the wobble head, a fabricator can adjust different modes, amplitudes and frequencies to maximize operation and minimize defects. In addition, the IPG welding head allows a fabricator to join dissimilar metals. Typically one material has a higher melting point or higher reflectivity than the other. Fabricators can control the melting behavior of both materials and balance them by choosing the right wobble parameters. By controlling the melting and solidification of materials' intermetallic layers, weld quality is improved.

"We combine two technologies into one compact module," says Samson. "This design facilitates simultaneous laser beam wobbling and welding seam tracking. By wobbling the laser beam, weld quality and finish is enhanced."

At the same time, the seam trackers allow automatic adjustment of the welding head lateral position when the seam location varies. "The welding head bridges gaps without filler material for high-quality finishes and better consistency throughout the seam," he says. The module is plug-and-play compatible with the D50 high-power welding head.

Cleaning & marking

Laser ablation is attracting attention from a growing customer base in markets like aerospace and automotive. The process can be used to remove paint, clean molds or remove oxide layers and coatings prior to welding. "It's quicker and produces less waste," notes Samson.

Ablation, marking and engraving are growing applications for fiber lasers.

Marking and engraving offer other applications where fiber lasers are noted for performance. "It's actually one of our biggest markets," says Samson. "Traceability requirements and regulation changes, particularly in the medical device arena, make the ability to mark and engrave parts essential."

Fiber lasers are also becoming more integrated with automated processes. "Right now, high throughput is driving the decision to automate a part line," Samson says. "A manufacturer also has to look at part design. If parts are suitable and the volumes are there, then fiber becomes a natural part of an automation solution."

IPG's building blocks—optical fiber and pumping diodes—give the company a platform for providing products with higher output powers and superior beam quality at a lower cost. Its cladding side-pumping technique and distributed single-emitter diode pumping architecture are key components to inserting fiber laser technology into mass production across an array of industries.

"We are a vertically integrated company," explains Samson. "The keys to our success are that we have developed the technology in house and made it cheaper. We are able to cast our net as wide as possible because our products are independent of any machine brand out there. We're trying to increase adoption of fiber laser by working with as many people as possible." **FFJ**

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