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INSIDE...

Laser Light Technologies' precision laser micromachining

LASERLIGHT TECHNOLOGIES, INC.

Specializing in custom high-tech laser micromachining services and R&D, Laser Light Technologies Inc. is pushing the limits of photonics technology.

Based in Hermann, Missouri, Laser Light Technologies Inc. is a precision laser micromachining company that incorporates every wavelength of the spectrum of light to create tiny parts and components for a diverse range of customers in the aerospace, automotive, medical, biotechnology, defense, energy, microfluidics, and semiconductor industries.

The company was founded by Phyllis Hannan as a laser engraving shop in 1985, but has since evolved to focus on more precision work under the leadership of her son Frank Hannan—micromachining products such as filtering devices for inkjet printers, multi-axes tube cutting, catheters, and angioplasty balloons. The dimensional tolerances they can hold, for example, are as small as ± 1µm.

All of Laser Light Technologies' manufacturing is done in-house in the U.S., and "accountability and responsiveness" are two key factors that separate the company from their competition. "Our employees are our most important asset, and we take great pride in the work that we do," says CEO Frank Hannan.

Harnessing the entire spectrum

Since different applications require different wavelengths, Laser Light Technologies makes use of every wavelength of light from ultraviolet (UV) to infrared (IR)—200nm up to 1500nm. They can accommodate applications ranging from cutting thick materials down to machining the tiniest feature in a 0.5mil piece of polymer.

"The UV spectrum is used to machine very fine features, thinner materials, and features down to the micron scale," explains Hannan. "When using IR, depending on the configuration, there's more power but less precision."

In terms of process, the company purchases lasers and then does the integration internally. "The integration dictates the processing requirements, such as a galvanometer, fixed-beam, or a multi-beam configuration," Hannan notes. "After the laser source, optics and mirrors direct and focus the beam into the final cutting device, we then incorporate ancillary components such as x-y stages, a vision system, and automation piece-handling units to make a complete system—and these are integrated to specific customer requirements."

The company also keeps its R&D systems as flexible as possible so that they can run multiple applications on it to prove processes. Once they have a contract with a customer, they build a custom system specifically for that application.

R&D work

R&D represents a large part (35 to 40%) of Laser Light Technologies' total revenue. This involves working closely with startups and established companies trying to release new designs to market. "Customers contact us to drill or machine their new design, and we'll assist the customer in determining tolerances for critical dimensions based on limitations using laser technology and then make recommendations to ensure it's machined cost-effectively and expeditiously," explains Hannan.

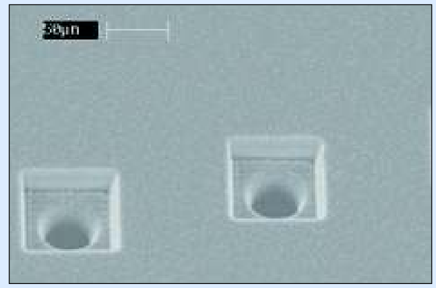
Once R&D is completed, if the customer's business model is to outsource, Laser Light Technologies will look into integrating systems and automation, and, if the volumes justify it, will take on the high-volume manufacturing and provide parts to them.

Microfluidics/Lab-on-a-chip

"We're working on projects that really push the edge of technology, and it's exciting to see just how far we can go," says Hannan.

One example of their work is creating lab-on-chips to detect pathogens in water supplies. They drill tiny blind holes into a chip, similar to dimples on a golf ball, onto which about 100 tiny glass balls coated with a wide variety of different pathogens are attached. These lab-on-chips are packaged and can then be inserted into an aqueduct or a local water supply to monitor water quality and detect dangerous situations.

Another example is making microfluidic lab-on-chip devices that are used by the oil industry to test oil samples. For these devices, the company machines 10µm hex-packed features on a chip to form intertwined grooves and channels that direct oil-flow to specific locations and enable analysis in the field.



Ink jet nozzles in orifice plates (Courtesy of Laserlight Technologies)

Company roadmap

Laser Light Technologies' goal for the next few years is to expand their presence in the medical industry. The company is currently erecting a 1000-sq.-ft. class 100 clean room for post process cleaning, packaging and assembly specifically to cater to medical industry needs.

Another focus is on ultrafast (femto) laser technology. This will enable Laser Light Technologies to machine down to a submicron scale and apply cold ablation techniques to new markets.

"During the next 3 to 5 years, we'll make significant investments in refining existing micromachining techniques," Hannan reveals. "True nanoscale manufacturing is at 200nm and below. As of today, a laser beam is only capable of producing submicron features by designing and installing complex optical systems that could prove to be cost-prohibitive in a production environment. Currently, we're evaluating new techniques to bridge this gap economically. Only a handful of cutting-edge companies can currently machine 1 to 2µm. This means great opportunities ahead for us in markets that haven't already been tapped."

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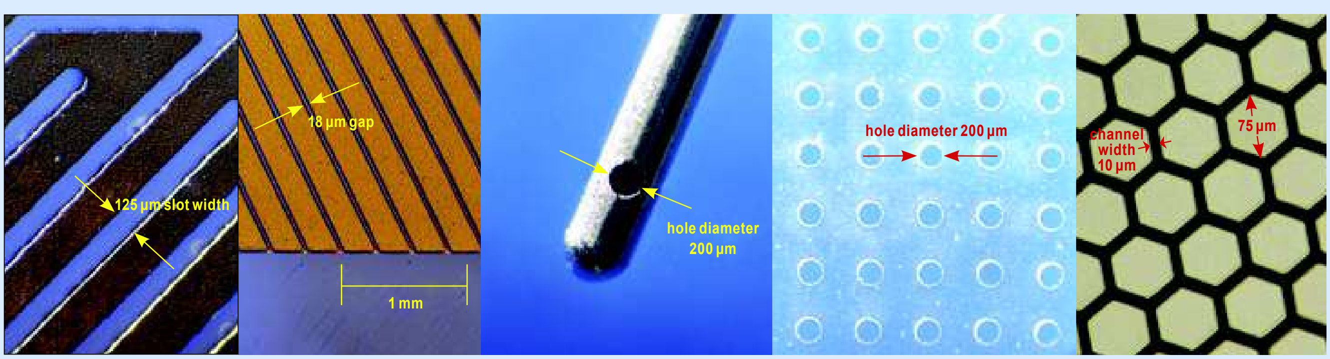

Left to right: 1. 125µm slot in Nitinol 2. 18µm cut in Kapton 3. 200µm hole in SS needle 4. 200µm hole array in polyurethane 5. Hex packed 10µm channels in polymer (Courtesy of Laserlight Technologies)