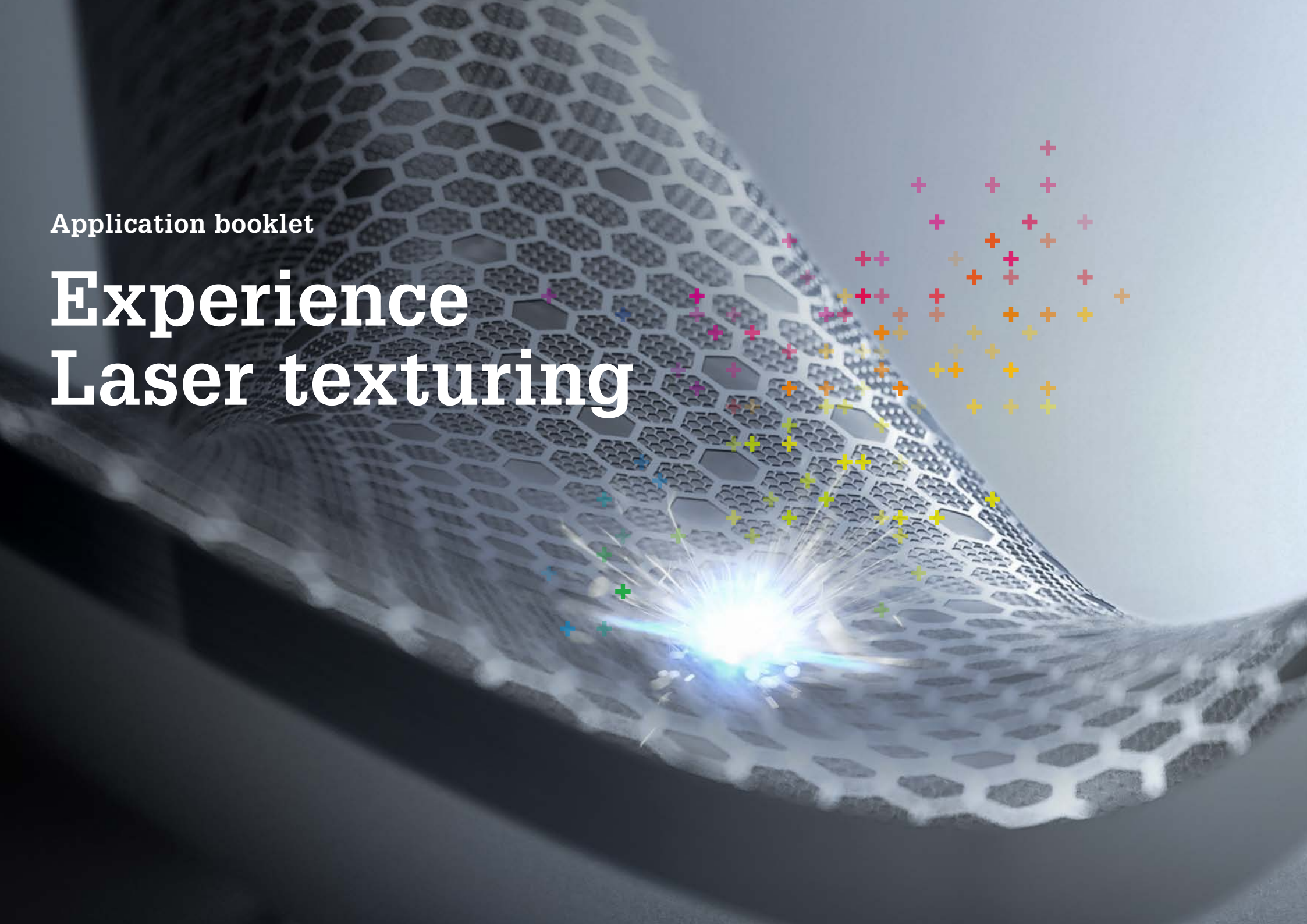


Application booklet

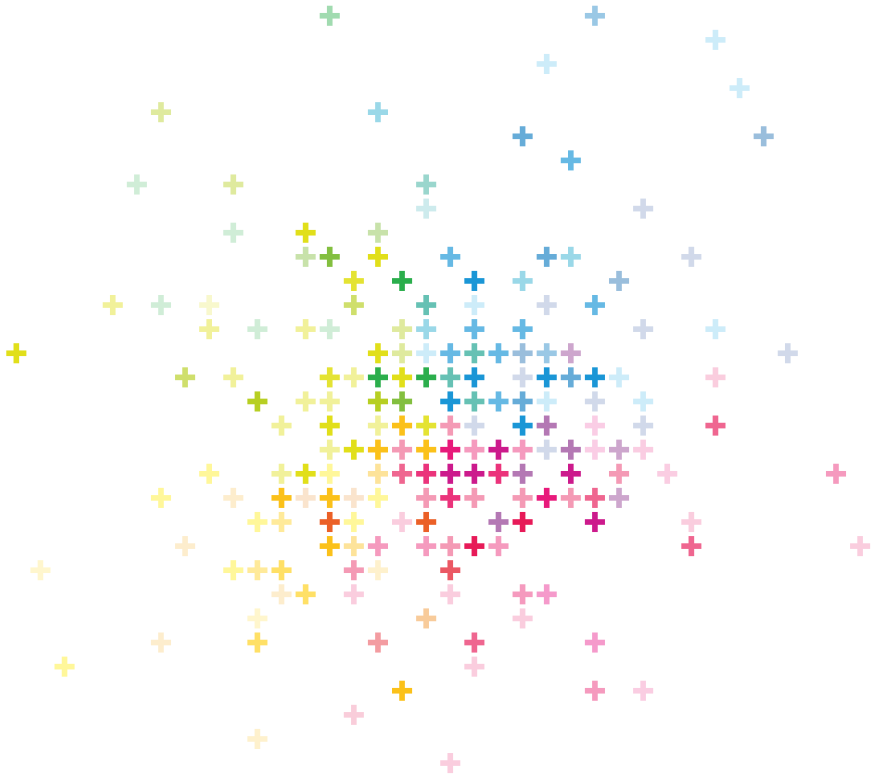
Experience Laser texturing

Passion for Precision

GF Machining Solutions

When all you need is everything, it's good to know that there is one company that you can count on to deliver complete solutions and services. From world-class electrical discharge machines (EDM), Laser texturing and Additive Manufacturing through to first-class Milling and Spindles, Tooling, Automation and software systems — all backed by unrivalled customer service and support — we, through our AgieCharmilles, Microlution, Mikron Mill, Liechti, Step-Tec and System 3R technologies, help you raise your game and increase your competitive edge.

We are AgieCharmilles.
We are GF Machining Solutions.



Contents

A new manufacturing era begins

Position your texturing operations for the future today with the Laser technology. Work digitally and stay on pace with the digital transformation and green manufacturing. These ecologically sound Laser texturing solutions help you seize new business opportunities, open up new innovation horizons, produce flawless quality, and achieve faster time to market.

Achieve faster time to market with less environmental impact

Time to market is key: You need to shorten your manufacturing chain while speeding it up in order to get your innovations to market faster. Laser texturing technology gives you access to the texturing operations essential to shortening your lead time by efficiently producing your textures internally.

Environmental sustainability is a major issue today and beyond so governments are pushing chemical etchers to quickly adopt cleaner processes. GF Machining Solutions is committed to reducing its technologies' environmental impact, as demonstrated by our Laser texturing technology's cleaner, more efficient production of textured products. Laser texturing avoids the need for environment-polluting traditional methods that limit your design potential. Bet on a future technology right now.

Innovate without compromise

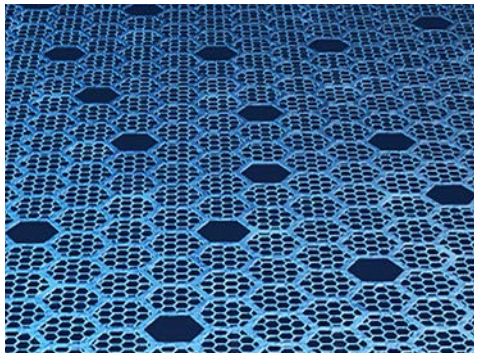
Say goodbye to conventional manufacturing limitations with a solution developed to reduce your technical and economic constraints. Be ready to propose new product designs with fewer limitations, and innovate with confidence as a more efficient technology is now able to reduce the cost-per-part gap between existing technologies while delivering higher quality. Experience a technology that eliminates guesswork in executing your distinct designs—even on complex 3D surfaces—and achieve the expected optimal results.

Work digitally: Answer your manufacturing challenges

Digital transformation is under way and Laser texturing overcomes the limitations of manual and traditional methods to drive your surface texturing transformation. Defeat the daily challenges of difficult-to-realize designs and quality deviations, and tackle functional surfaces in order to seize new business opportunities. We understand your concerns: Our Laser texturing technology helps you keep pace in an ever-changing manufacturing world.

Enhancing your manufacturing process

Work with a 3D model
Import your 3D shape into the all-in-one software package to precisely determine the right position of the Laser operation that you would like to execute.



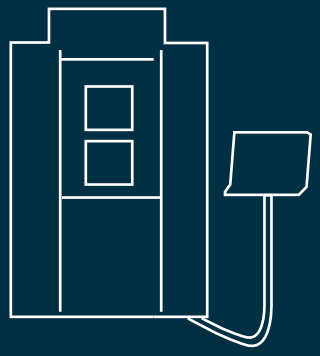
Develop new textures without limitations
Work with gray scale textures without design limitations. Create original textures in-house and from natural surfaces by reverse engineering via 3D scanner. Let your textures express your imagination.

Precisely apply your textures
Our software eliminates the guesswork, allowing our Laser solutions to recreate your distinct designs on large and complex surfaces, ensuring quality and precision. Manual tasks are then reduced to the minimum.

Execution without deviations
Catch additional market opportunities with a versatile solution: Realize engraving, marking and texturing operations, all with the same machine, thanks to the all-in-one software package. Your design is perfectly repeated.

LASER P 400

Simplify your production of small parts and boost your quality while benefiting from great manufacturing agility. The LASER P 400 U series is made specifically for efficient production of small parts. This scalable concept offers you the flexibility to anticipate your future needs: Start with a standard machine configuration with a nanosecond Laser and be positioned—as your business grows—to add a femtosecond laser to achieve perfect Laser texturing and blasting operations.



Increased quality in parts production

Boost your manufacturing flexibility

Be ready to quickly jump into the next manufacturing opportunity with a compact, multi-process solution that is adaptable to your application needs. With our solution, you get the success-triggering advantage of having a machine that's ready to move from one type of 3D job to another. At the same time, with this series large working area, you can expand your application possibilities, and its small footprint maximizes your productivity per square meter.

Increase your manufacturing efficiency

Efficiency is a key contributor to optimized total cost of ownership (TCO), fast return on investment (ROI) and overall margin, and this series' Automation readiness puts you on the path to achieving all three. You can count on our Automation solutions to reduce machine downtime and minimize your risks of staff turnover and human error, while maintaining the highest level of production quality.

Innovate without compromises

Increase your design possibilities and quality and expand your product design horizons today by getting a solution that allows you to engrave and texture a wider range of materials without recast layer or burrs: Our AgieCharmilles LASER P 400 U's ultra-short-pulsed femtosecond Laser puts uncompromising innovation within your reach. Furthermore, you can achieve perfect machining for years to come with our Protect and Secure contracts to keep your femtosecond Laser solution operating at highest efficiency.

Simplify and secure your part manufacturing

Simplify your production process to save time and money by having process stability and uniform quality across every design reproduction. With our fully digital solution, you'll easily overcome the challenges of conventional machining methods and get on the fast track to executing small geometries with fewer manufacturing steps.

Reduce machining, setup and inspection time

YOUR BENEFITS

Avoid need for manual sand blasting to speed up your production

Limit production inspection to one piece per lot compared to a systematic inspection process

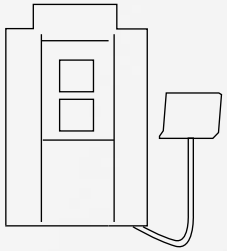
Cervical fusion plate by Laser

Perfect blasting homogeneity

Setup in seconds

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 400 U



PERFORMANCE RESULTS

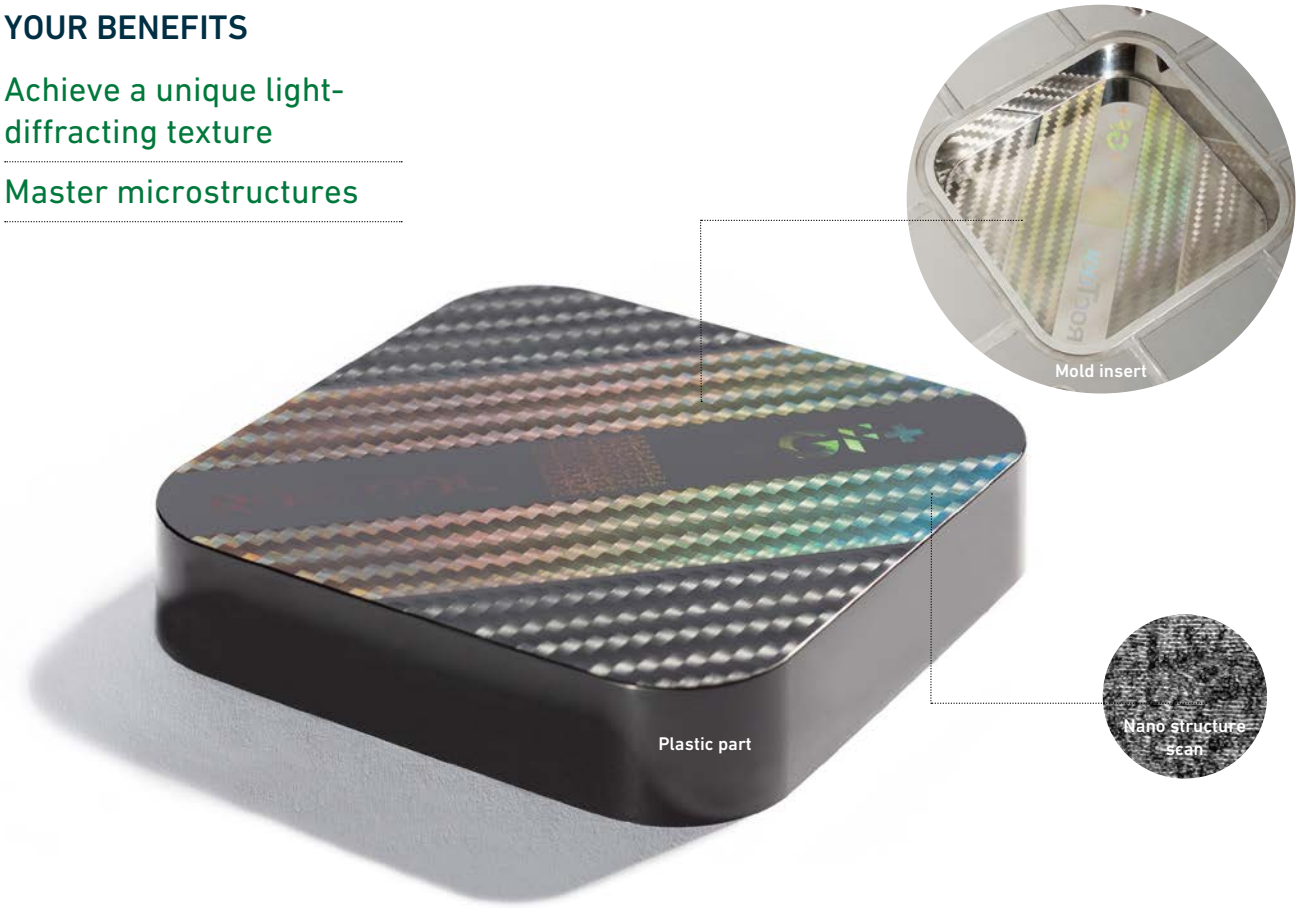
Market segment	Medical
Material	Titanium grade 5
Part dimension	47 x 11 x 31 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics Blasting	10 min

Dare to propose new design possibilities with microtextures

YOUR BENEFITS

Achieve a unique light-diffracting texture

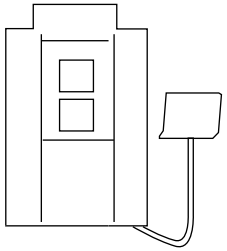
Master microstructures



ICT plastic part made with RocTool

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 400



PERFORMANCE RESULTS

Market segment	ICT
Material	Steel DIN 1.2085
Part dimension	90 x 90 x 18 mm
Laser (Type/Power)	Dual Laser femto IR 20 W FP and Nano IR 30 W FP
Characteristics	
Carbon	37 min
Logo	9 min

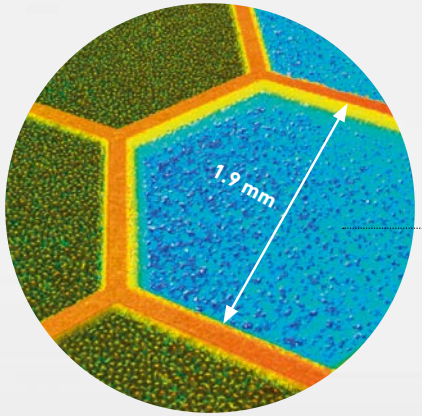
Achieve higher quality in a single setup

YOUR BENEFITS

Boost your quality with the combination of Laser blasting and deep black

Execute your work in a single setup

Achieve perfect repeatability



From femto to nano Laser **0.7”**

Perfect texture profile

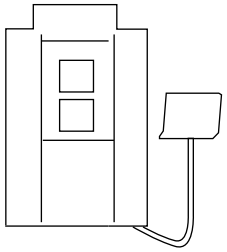
Digital technology

Watch face

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 400 U

Dual Laser



PERFORMANCE RESULTS

Market segment	Watchmaking industry
Material	Steel DIN 1.2085
Part dimension	Ø 40 x 10 mm
Laser (Type/Power)	Femto IR 20 W FP and Nano IR 30 W FP
Characteristics Machining time	22 min

Simplify your machining process

YOUR BENEFITS

Avoid cutting tools and electrode production

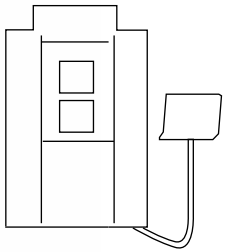
Get the right profile accuracy and the right surface finish in a single operation

Hard metal tool insert

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 400 U

Laser Flexipulse



PERFORMANCE RESULTS

Market segment	Cutting tools
Material	Carbide H40S
Part dimension	18 x 18 x 6 mm
Laser (Type/Power)	Femto IR 20 W FP
Characteristics Machining time	6h

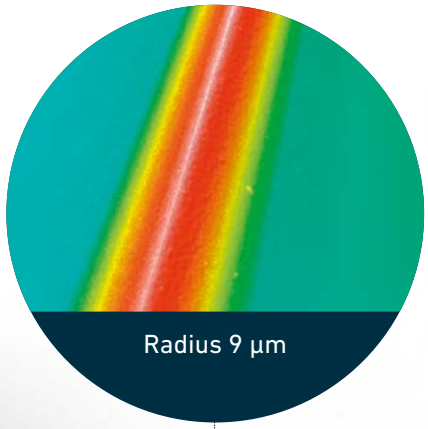
Highest quality—fast—with a unique technology combination

YOUR BENEFITS

Speed up your operations

Reduce number of electrodes and cutting tools required

Extend punch lifetime with a higher punch quality



Hard metal tool insert

Surface finish Ra 0.1 µm

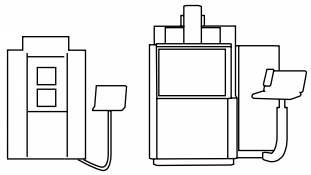
Shorter roughing operation

50% less Electrodes used

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 400 – roughing

AgieCharmilles FORM S 350 – finishing



PERFORMANCE RESULTS

Market segment	Cutting tools
Material	Carbide H40S
Part dimension	18 x 18 x 6 mm
Laser (Type/Power)	Nano 30 W FP
Characteristics Machining time	5h15

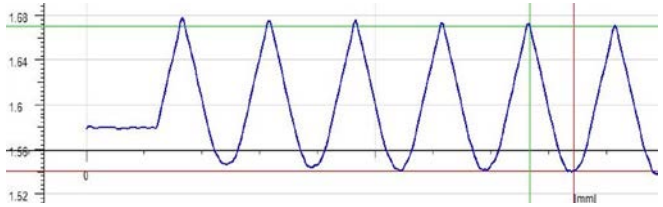
Boost your operations

YOUR BENEFITS

Simplify your three-dimensional engraving operations

Boost your productivity and realize marking and engraving operations on the same solution

No electrodes

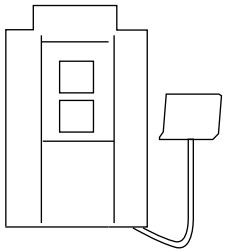


Done on the **LASER P 400** only

Embossing dies

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 400 U

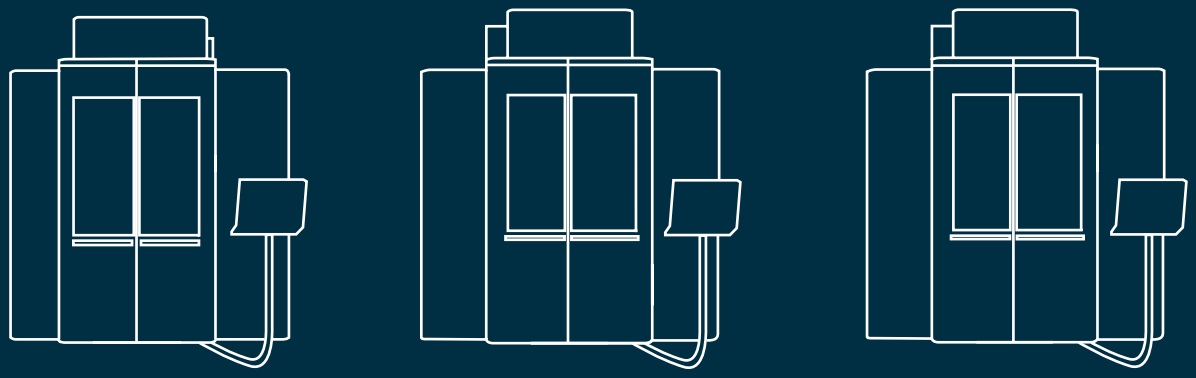


PERFORMANCE RESULTS

Market segment	Watch industry
Material	Hardened Steel 1.2379
Part dimension	Ø 40 x 30 mm
Laser (Type/Power)	Femto 20 W FP
Characteristics	
Machining time max.	4h
Depth	0.2 mm

LASER P 600/1000/1200 U

Experience the technology: Reduce non-quality risks, gain true design freedom and simplify your processes with a fully digital, green, technology. With our Automation-ready, multi-process solution at your disposal, you'll be set to respond to new surface texturing demands with quality and higher productivity.



Increased opportunities

Get the first part right

Ramp up your quality, innovate and limit deviation risks with our unique, all-in-one, patented software package designed to help you think and create without limitations—and perfectly reproduce your original idea on the very first part. Control your design from preparation to execution and achieve the quality you expect, and easily, quickly apply incomparably high-quality textures with Smartpatch. And, whatever your part size, you'll effortlessly execute homogenous blasted surfaces, right where you want them, without the deviation risks posed by manual processes.

Accelerate your operations

Take your operations to the next level of agility: This series gives you the competitive advantage of being able to to move from one type of job to another. Get all of the flexibility you need in order to capture new business opportunities with this solution's Automation readiness, so you can start profiting from Automation: Control your cost per part by loading production batches to save time and reduce the risk of human error.

Boost your texturing possibilities

Offer innovative, precise textures due to this solution's unique combination of software and hardware. This series' cast iron structure ensures repeatable quality, productivity and accuracy to sharpen your competitive edge. Be ready to answer automotive's positive mold texturing trends with the machine's combination of a tilting A axis (+135°/-50°) and increased Z axis travel embedded in the all-in-one Laser head.

Quickly simplify your process

Process stability and uniform quality across every design reproduction is at your fingertips with our fully digital solution. Overcome the challenges of conventional surface texturing methods like sandblasting and chemical etching, thanks to Laser texturing's clear advantages. It allows you to texture molds without masking, hand polishing or third parties, and our unique and dedicated Laser Design software gives you Laser blasting capability and unmatched texturing. For example, our solution allows electrode-free engraving of simply molds to simplify your process.

One single solution to advance your flexibility

YOUR BENEFITS

Be flexible:
Execute multiple machining operations with the same solution

Master quality with a 100% digital technology

Achieve total freedom of design

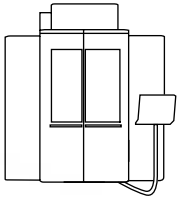
Volcano

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 1000 U

Laser texturing, blasting, engraving and machining on the same part

All-in-one Laser software package



PERFORMANCE RESULTS

Market segment	Mold and die
Material	Stainless steel 1.4301
Part dimension	Ø 80 x 28 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics	
Max. depth	2 mm
Ra	1.2 to 4.7 µm

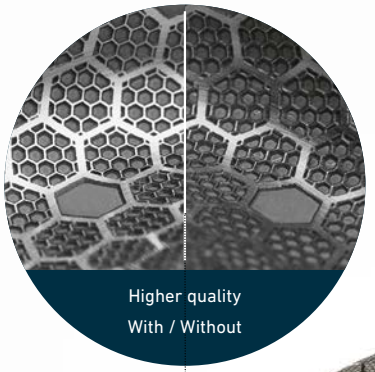
Boost quality and productivity through innovation

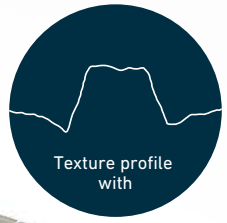
YOUR BENEFITS

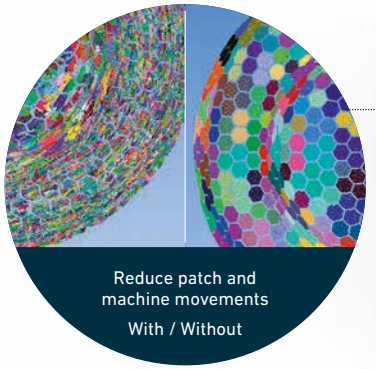
Get unequaled texture quality

Avoid patch lines with smart tool path generation

Boost productivity by up to 30%



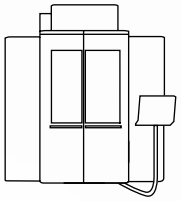




Smartpatch **2x** patents

APPLIED TECHNOLOGIES

Innovative Smartpatch technology



PERFORMANCE RESULTS

Market segment	Mold and die
Material	Stainless steel 1.4301
Part dimension	Ø 80 x 28 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics	
Without Smartpatch	10h38
With Smartpatch	7h25

Eliminate manual operations with digital solutions

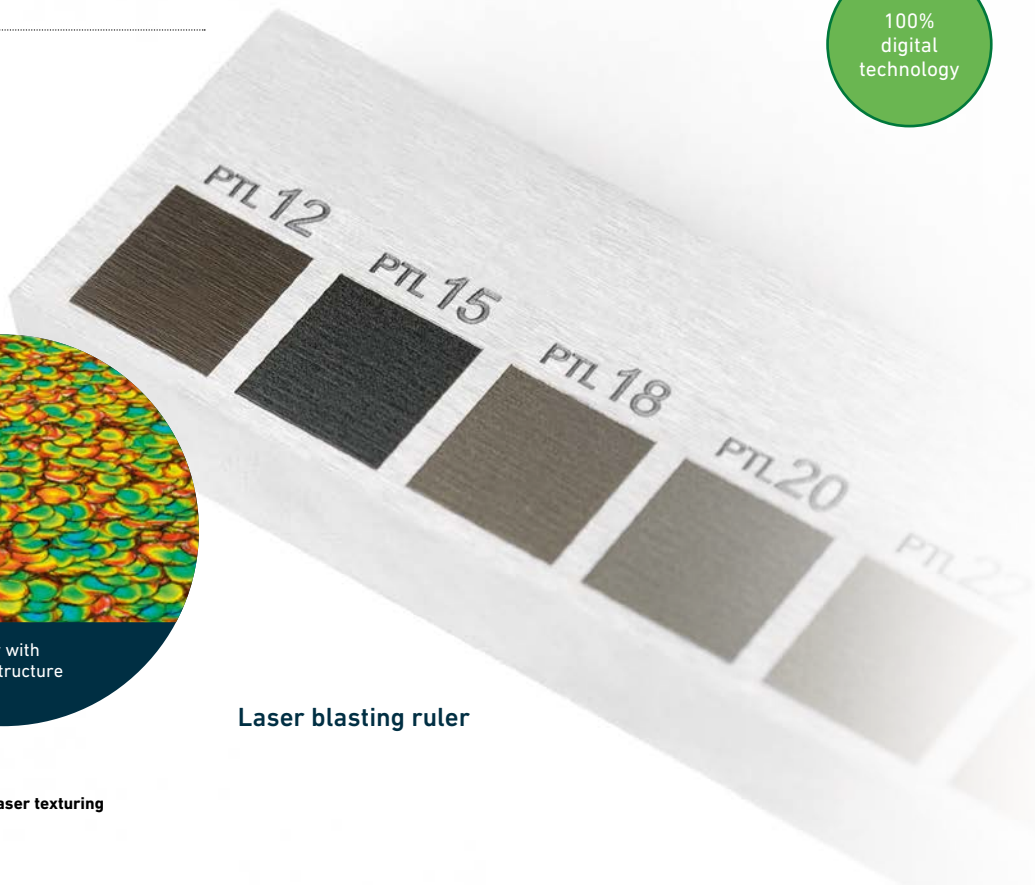
YOUR BENEFITS

Get full control of your surface characterization

Master surface finish to control your production quality

Up to Ra 0.4 µm

100% digital technology

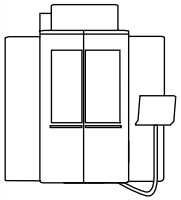


Laser blasting ruler

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 1000 U

Laser blasting operation



PERFORMANCE RESULTS

Market segment	Demo part
Material	Stainless steel 1.4301
Part dimension	150 x 30 x 5 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics Average machining time	4 min per zone

Raise your brand's visibility

YOUR BENEFITS

Design without limitations to boost your differentiation

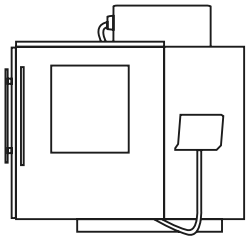
Optimize your process and finish your sidewall in a single operation

Easily reproduce your traditional design without cutting tools

Tire side wall

APPLIED TECHNOLOGIES

AgieCharmilles LASER P 1200 U Dedicated to tire molds



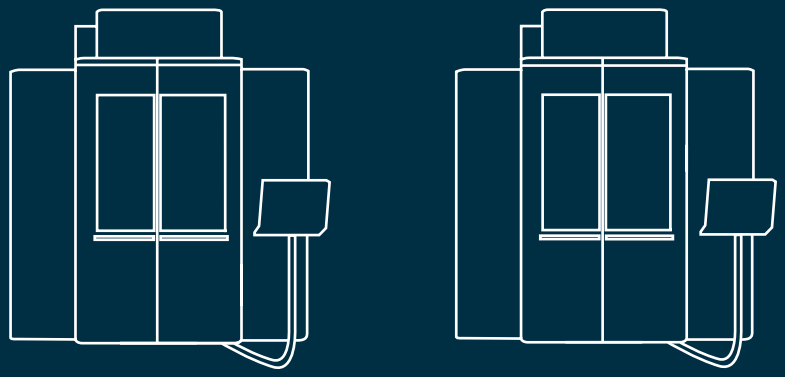
Dedicated Solutions

PERFORMANCE RESULTS

Market segment	Automotive
Material	Stainless steel 1.4301
Part dimension	300 x 165 x 68 mm
Laser (Type/Power)	Nano IR 100 W
Characteristics	
Carbon	14h58
Logo	1h
Arrows	4h05
Safety letters	16 min

LASER S 1000/1200 U

Improve the productivity of your texturing without compromising on quality. With the LASER S series, be ready to catch additional business opportunities with a unique machining flexibility and optimization capabilities: Use the full potential of our latest-generation Laser texturing solution to outpace your competitors, and allow innovation at a controlled cost per part.



Innovative Texturing. Accelerated Productivity.

Accelerated productivity

Shorten your machine ROI with faster 3D texturing operations. Produce your innovations at a controlled cost per part. Experience the most efficient five-axis Laser texturing machine dedicated to the mold and die industry. The secret is to reduce all mechanical movements of the Laser head to a minimum. You get increased speed, too, thanks to the faster 3D operations allowed by our high-speed 3D scanning system, Smartscan, and an increased marking field. Execute your latest innovations in record time—and make your distinct design a reality.

Increased quality

Keep pace with the trend toward geometrical patterns. Experience the market's best five-axis Laser texturing solution with leading-edge hardware capabilities and performance. Strike the perfect balance of innovation and perfect texturing operations—in record time—and boost your quality. Get a consistently stable machining process to meet quality requests thanks to our Laser head's thermostabilization. Easily avoid texture shifts between details with our high-speed 3D scanning system and its large marking field. Find the right quality-to-speed ratio for your application with our Laser Flexipulse fine-tuning Laser parameters.

Innovative texturing

Boost your innovation capabilities with Laser blasting capabilities and Smartpatch. Laser blasting helps to optimize quality, allowing you to repeat your blasting operations on the most complex part without quality deviations. Functional surfaces for lighting, for example, require all the freedom of our Laser blasting capabilities: You are free to set up the right 3D surface aspects to match your application. Win time and quality: Our innovative Smartpatch system helps you stay on track with most challenging, innovative geometrical textures.

Extended manufacturing agility

Increase your business versatility with the one solution that can switch from one defined Laser source to another. Seize every opportunity for success with a solution adaptable to your daily needs—ideal for job shops and mold makers who must respond to new business challenges in the shortest time and with perfect quality and controlled cost per part. Fine-tune your laser parameters with Flexipulse for perfect quality in line with your specific project, and execute Laser blasting, texturing and engraving of forms or texts all in the same setup.

Drive Medical Implant Innovation

YOUR BENEFITS

Increase product performance and reduce costs with multiple surface textures realized in a single setup

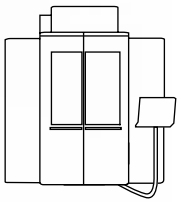
Innovate with controlled cost per part and unprecedented productivity

Substitute grit blasting and acid etching with a cleaner process

APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1000 U

Selective Laser blasting



PERFORMANCE RESULTS

Market segment	Medical
Material	Titanium Grade 5
Part dimension	80 x 10 x 30 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics Machining time	37 min

Simplify your manufacturing process with a stable production output

YOUR BENEFITS

Maintain consistent quality over time with Laser technology

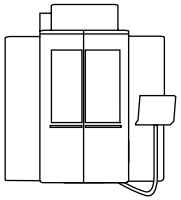
Reduce the use of electrodes and cutting tool costs

Neck ring

APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1000 U

High-speed 3D scanning system



PERFORMANCE RESULTS

Market segment	Packaging
Material	CX stainless steel (from Additive Manufacturing)
Part dimension	49 x 31 x 45 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics Machining time	3h11

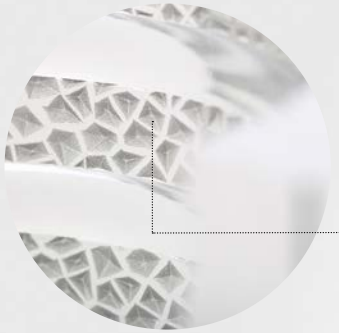
Simplify your manufacturing steps and expand design possibilities

YOUR BENEFITS

Be ready to realize the complete process in house— no subcontractor needed

Boost your productivity and quality to shorten your leadtime

Profit from unlimited texture possibilities to open up new business opportunities



Machining time -40%*

* Vs LASER P series

Machining time -24%*

* Vs LASER P series

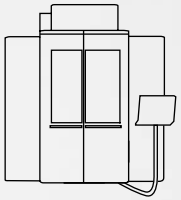
Blow mold

APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1000 U

Smartpatch helps boost machining time

High-speed 3D scanning system and larger marking field



PERFORMANCE RESULTS

Market segment	Packaging
Material	Aluminum 6061
Part dimension	96 x 48 x 180 mm
Laser (Type/Power)	Nano laser 50 W
Characteristics	
Texture depth max.	0.25 mm
Machining time (side)	44 min
Machining time (bottom)	6 min

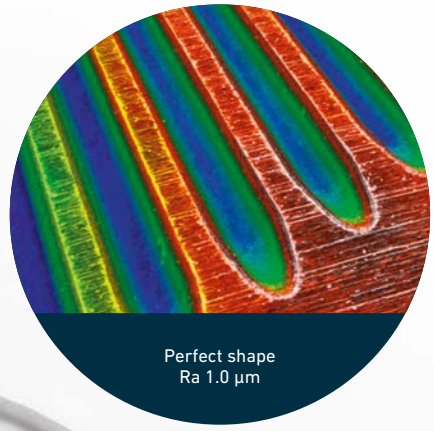
Boost your productivity with one single setup

YOUR BENEFITS

Simplify your process and avoid the need for additional machining steps

Master quality and achieve a consistent shape whatever the production volume

Propose innovative shapes and logos



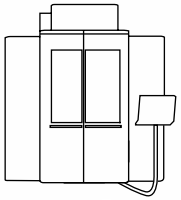
Cap mold by Laser

Three operations done on one machine

APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1000 U

High-speed 3D scanning system



PERFORMANCE RESULTS

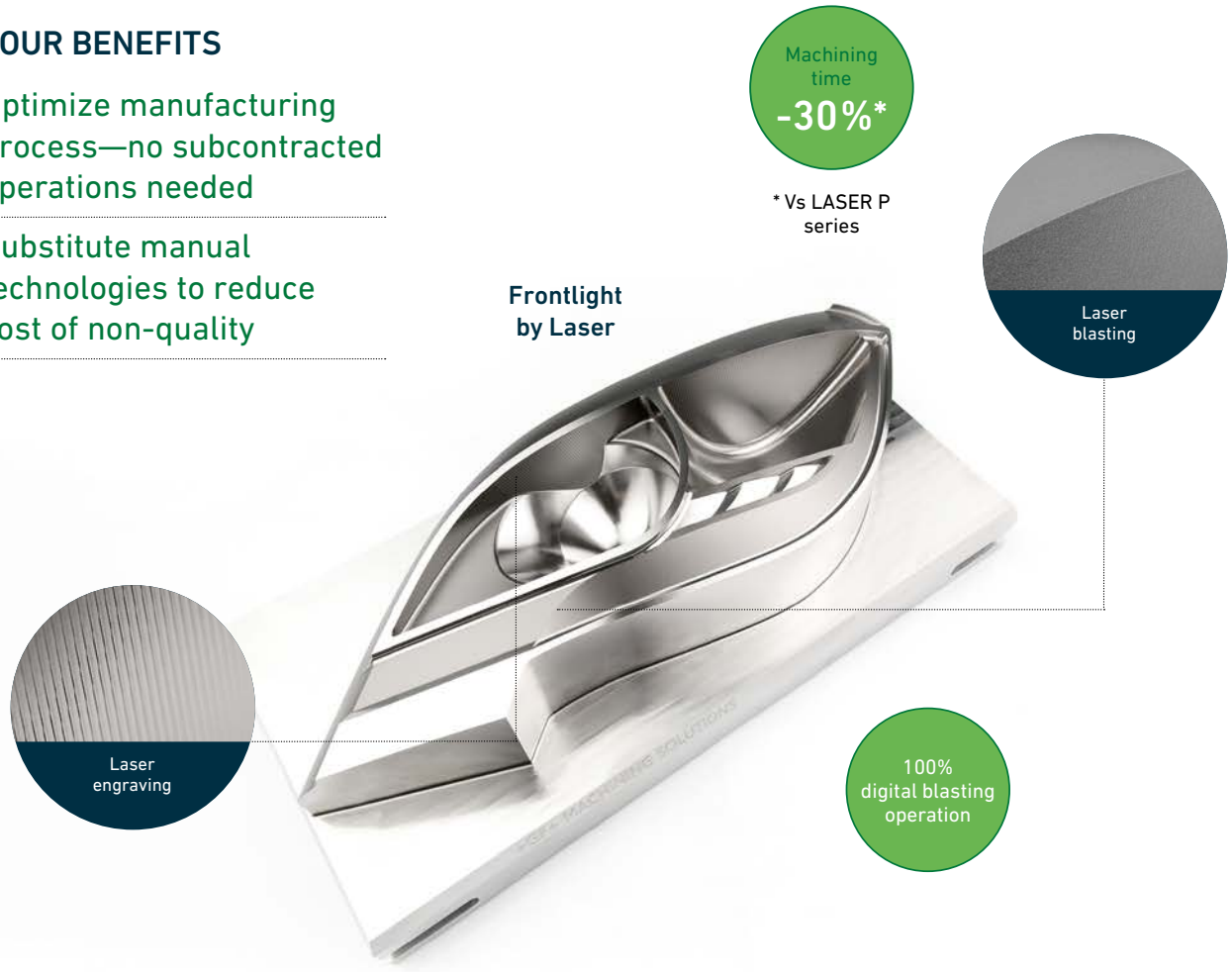
Market segment	Packaging
Material	Stainless steel 1.4301
Part dimension	Ø 52 x 60 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics	Machining time 3h11
Characteristics Machining time (grooves and logo)	1h35

Optimize your manufacturing process to shorten your leadtime

YOUR BENEFITS

Optimize manufacturing process—no subcontracted operations needed

Substitute manual technologies to reduce cost of non-quality

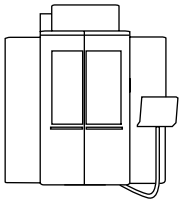


APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1200 U

Laser blasting

High-speed 3D scanning system and larger marking field



PERFORMANCE RESULTS

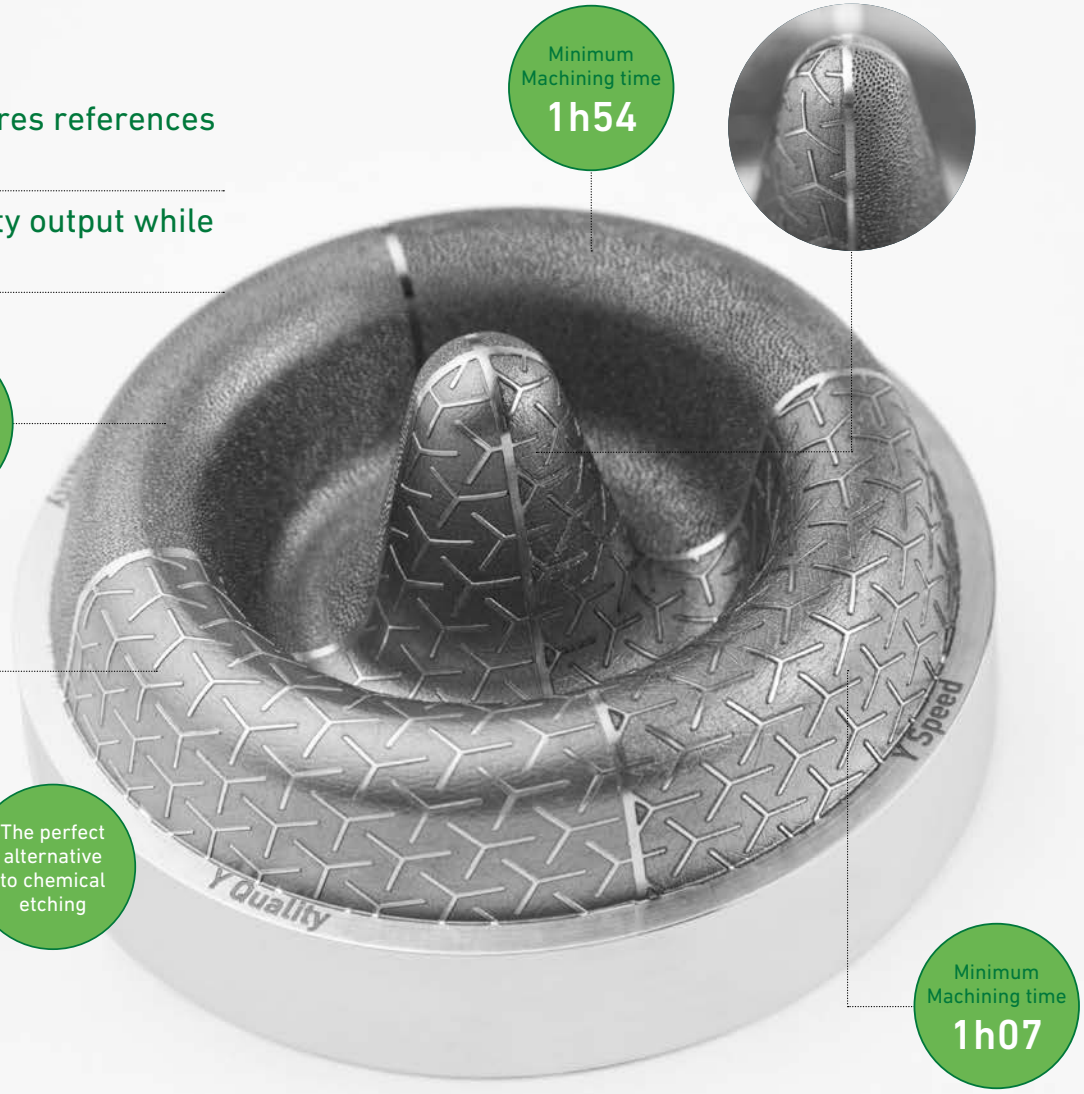
Market segment	Automotive
Material	Steel 1.2085
Part dimension	320 x 130 x 78 mm
Laser (Type/Power)	Nano IR 50 W
Characteristics	
Total machining time	11h58
Light guides	44 min

Master your manufacturing process

YOUR BENEFITS

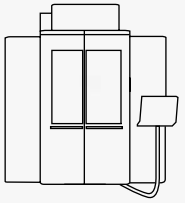
Reproduce textures references with quality

Boost your quality output while saving time



APPLIED TECHNOLOGIES

- AgieCharmilles LASER S 1200 U
- Smartpatch at 100%
- High-speed 3D scanning system and larger marking field
- Laser finishing strategies to boost texture quality



PERFORMANCE RESULTS

Market segment	Automotive
Material	Stainless steel 1.4301
Part dimension	Ø 80 x 40 mm
Laser (Type/Power)	Nano IR 50 W

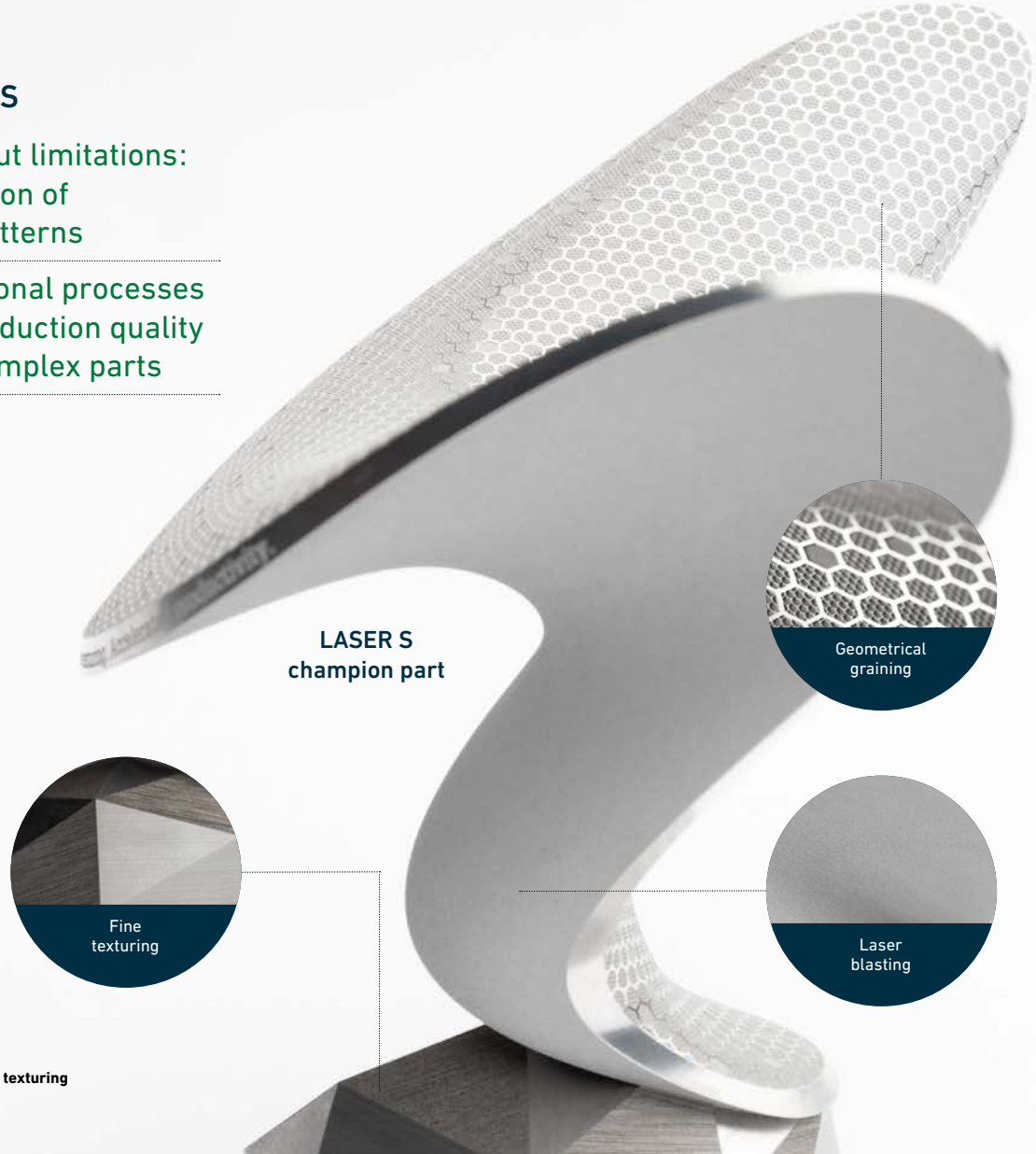
Allow for unlimited surface design capabilities at controlled cost

YOUR BENEFITS

Innovate without limitations: Perfect execution of geometrical patterns

Replace traditional processes to enhance production quality on the most complex parts

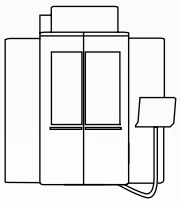
Smartpatch performance at **100%**



APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1000 U

Laser blasting combined with Laser texturing



PERFORMANCE RESULTS

Market segment	Automotive/ICT/Packaging
Material	Aluminum 6061 and stainless steel 1.4301
Part dimension	114 x 128 x 133 mm
Laser (Type/Power)	Nano IR 30 W FP
Characteristics	
Geometrical texturing	7h32
Blasting	1h50
Engraving	2 min
Fine texturing	9 min

Execute your latest innovative projects—faster

YOUR BENEFITS

Be flexible:
Execute multiple machining operations with the same machine

Get the productivity, quality and product differentiation that are key to staying ahead in today's market

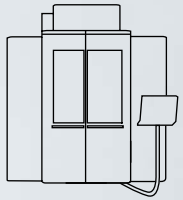
LASER S pocket part

APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1000 U

Smartpatch and Smartscan at 100%

High-speed 3D scanning system and larger marking field



PERFORMANCE RESULTS

Market segment	Automotive, ICT, Packaging
Material	Stainless steel 1.4301
Part dimension	Ø 60 x 30 mm
Laser (Type/Power)	Nano IR 30 W FP
Characteristics	
Engraving	3h31
3D marking	1 min
Blasting	3 min
Texturing	39 min

Improvements	ENGRAVING	3D MARKING	BLASTING	TEXTURING
2017 **Introduction of Smartpatch**	N/A	N/A	N/A	Machining time **-51%**
2018 **Introduction of Smartscan**	Machining time **-18%**	Machining time **-4%**	N/A	N/A
2019 **Introduction of LASER S series**	Surface finish from Ra 3 µm to **Ra 1 µm**	Machining time **-43%**	Machining time **-49%**	Machining time **-22%**

Chemical etching Vs. Laser ablation

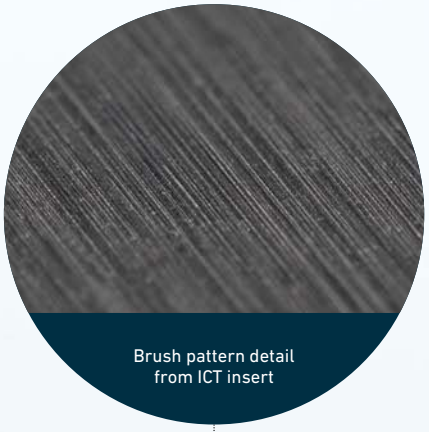
The right alternative to chemical etching

YOUR BENEFITS

Shorten your lead time thanks to digital technologies

Master high quality and counterbalance the risk of manual mistakes

Be ready to execute new grain designs without difficulties

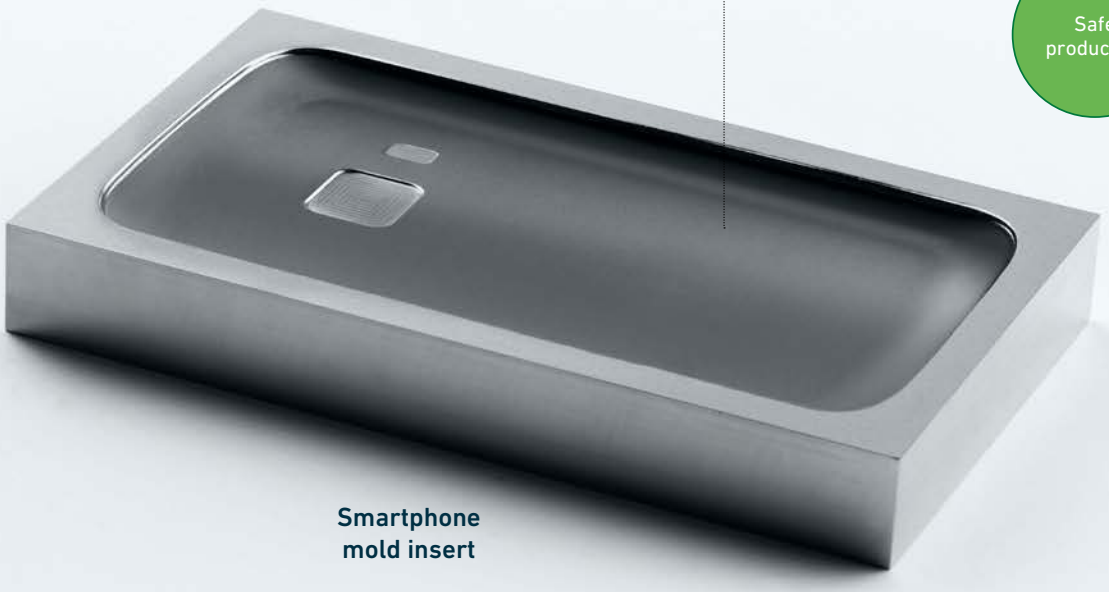


Brush pattern detail from ICT insert

Less limitations

Faster execution

Safe production

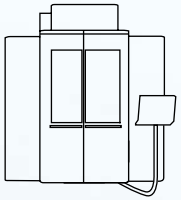


Smartphone mold insert

APPLIED TECHNOLOGIES

AgieCharmilles LASER S 1000 U

High-speed 3D scanning system and larger marking field



PERFORMANCE RESULTS

Market segment	ICT
Material	Stainless steel 1.4301
Area to engrave	~ 250 x 70 x 5 mm
Laser (Type/Power)	Nano IR 30 W FP
Characteristics Machining time	3h

Boost your manufacturing efficiency and focus your operators on strategic tasks

Easily master the process and counter the risk of staff turnover
Mold texturers are increasingly difficult to find due to waning interest in the crafts and high staff turnover. Prepare your operators for the digital future today while readying them to perfectly execute increasingly complex jobs.

Increase the number of automatic operations
Machine with confidence that you will keep your promises with our automatic machine operations. We make sure your production is completed within the time you promised and with a limited risk of errors.

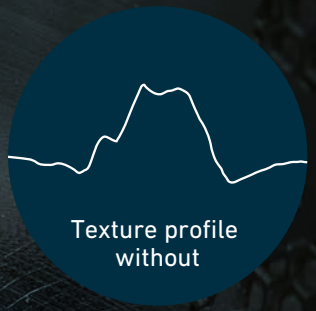
Chemical etching process

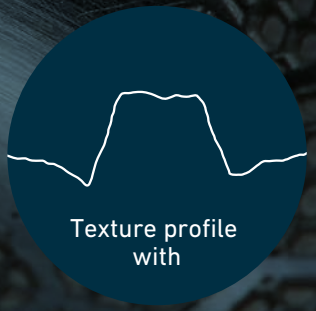
	Expected time	Real time
Check and mold protection	1h	1h15
Sandblasting	13 min	23 min
Applying photoresistant	9 min	12 min
Drying/waiting	3h57	6h36
Applying the film	2h1	2h53
UV exposure	19 min	19 min
Film removal and cleaning	13 min	13 min
Manual texture adjustments	59 min	58 min
Depth and gloss measurement	35 min	35 min
Etching	11 min	11 min
Total	**9h37**	**13h35**

Laser ablation process

	Time	Hidden time
Check mold and cleaning	4 min	–
Measuring mold	20 min	–
File preparation	–	1h30
File computation	–	40 min
Part setup and referencing	15 min	–
Laser machining	3h	–
Mold cleaning and inspection	20 min	–
Gloss measurement	1 min	–
Scanning (depth and shape)	15 min	–
Total	**4h15**	**2h10**

Smartpatch





Software revolutionizes Laser texturing to guarantee quality and productivity

Significantly greater productivity—ranging from 20 to 40 percent depending on the application—and quality are among the cost-saving benefits reported by early adopters of GF Machining Solutions' latest-generation GF Laser Workstation Software. Moreover, testing in the GF Division's own application centers confirms that the optional software suite with Smartpatch technology can accelerate texturing speed by 30 percent compared to the speed of the same process without Smartpatch depending on the application.

These gains in production efficiency and quality are made possible by the process intelligence engineered into GF Laser Workstation Software 1.8.0's Smartpatch technology. With advanced generation of sections—or patches—of texture, it unites smart machining strategies, increased quality, and optimized productivity to move customers into the future. And advance Laser texturing as a manufacturing process.

In the highly competitive mold and die world, manufacturers can't compromise on time or quality: They are under pressure to produce the highest quality textured surfaces on the first attempt in order to reduce turnaround time, manage costs, and maintain quality.

Laser texturing uses a Laser beam to create textures by removing workpiece material layer by layer in a non-polluting, no-contact way. Because it is a fully digital technology, Laser texturing can sustainably apply decorative textures, including complex geometries, over infinite iterations with highest repeatability: Virtually any design in a digital format can easily be applied to a 3D workpiece surface. And since the cutting tool is a Laser beam, tool wear and breakage are never an issue.

The challenge

To date, even the most advanced Laser texturing solutions have forced manufacturers to make quality and/or productivity sacrifices, because most existing Laser texturing machines randomly apply textures to the workpiece surface, working from one area to the next to remove material in patches. Without a smart patching solution, productivity and quality are compromised due to inefficient texturing strategies and texturing errors induced by Laser head movement. Movement can induce position deviations from the desired texture design due to ambient thermal changes, resulting in undesirable lines along the perimeters of patches and distorted textural details. These deviations lead to quality errors that are especially noticeable on very fine textures such as injection molded auto interiors, watches, and information and communications technology (ICT) products.

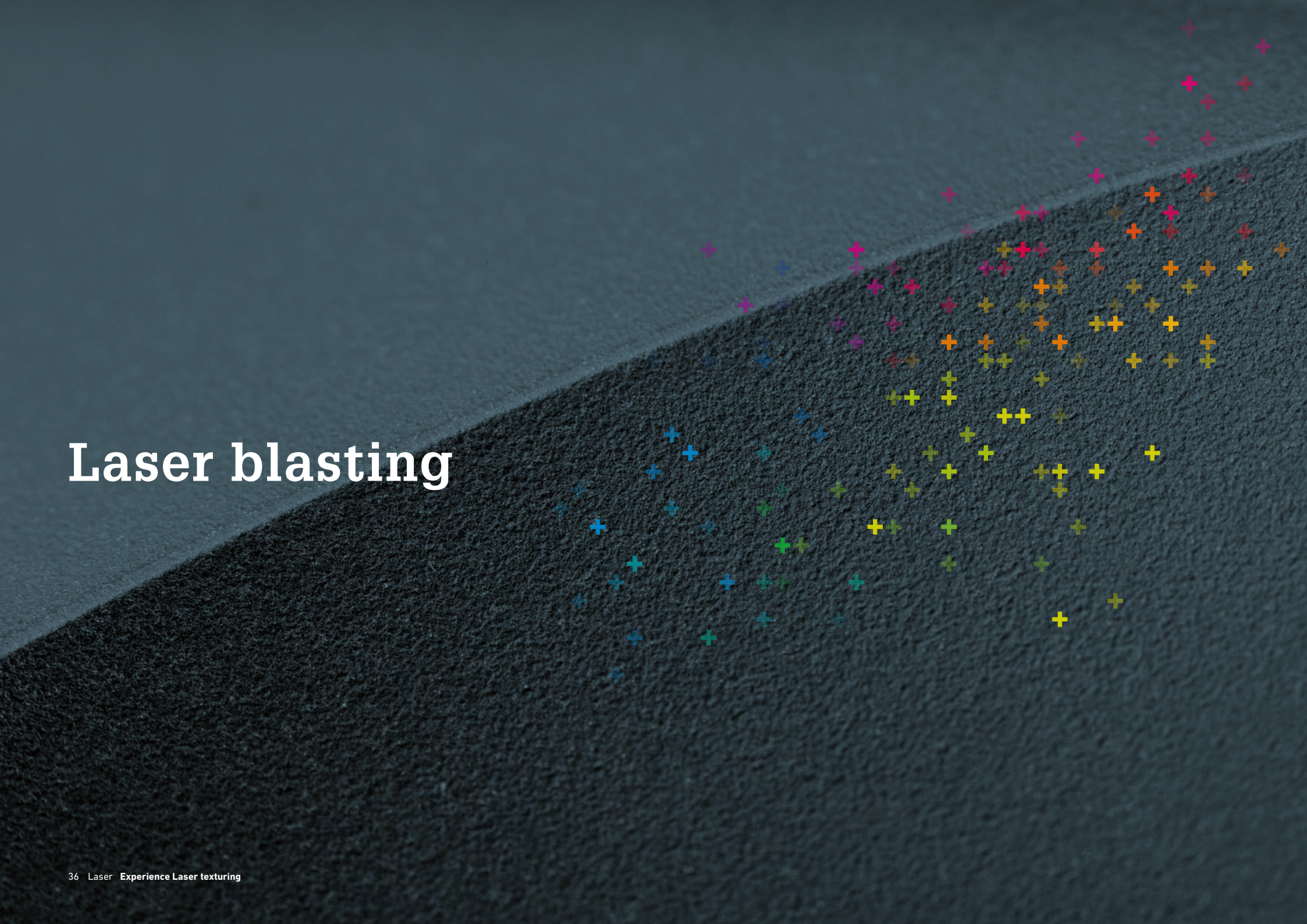
The solution

To establish the revolutionary quality- and productivity-enhancing advantages of Smartpatch, GF Machining Solutions' developed a highly demanding stainless steel demo part featuring a complex honeycomb texture. Without Smartpatch, this workpiece required 30 times more patches; with the solution, a customer can produce the same workpiece with 30 times fewer machine movements than with a program generated by standard methods.

Smartpatch detects "pockets" where the texture can be unlinked and its details can be realized in a single movement. Upon detecting a pocket, the machine makes a patch around it and executes all of its layers. Random application of textures becomes a thing of the past as Laser head movement is minimized, delivering high-quality results at highest efficiency. Another quality-advancing benefit is the solution's ability to avoid patching lines and perfectly respect the desired geometry of the workpiece.

These results are confirmed by industrial users. Market leader reported that the smart Laser patching solution benefited 50 percent of his production over a six-month period. A Laser texturing and cast parts repair services provider reported that Smartpatch increased his five-axis texturing productivity by 20 percent and his three-axis engraving productivity by 40 percent.

Laser blasting



Pushing the technological boundaries with Laser blasting

The appeal of Laser blasting—bombarding a workpiece with up to thousands of Laser points per square millimeter to create a homogenous surface finish—is obvious: The process is fully digital, non-polluting and no machinery makes contact with the workpiece. GF Machining Solutions, already the market reference in surface standardization by electrical discharge machining (EDM), today leads the way to the future with its revolutionary 3D Laser surface texturing, laying the foundation for truly functional 3D Laser texturing.

In terms of surface characterization on machined workpieces, surface roughness—expressed as roughness average (Ra)—is insufficient for conditions which may present proper roughness but leave much to be desired in terms of optical appearance. Laser blasting, which uses a pulsed fiber Laser to literally bombard a workpiece surface with Laser energy, delivers unsurpassed homogeneity of machined surface and extreme regularity of surface characteristics.

The challenges

Despite the appeal of Laser structuring, the programming can be difficult and time-consuming, depending on application complexity. With the introduction of Laser blasting capabilities included with its all-in-one Laser workstation software and, more specifically, in Laser Design, the GF Division revolutionized the world of surface structuring. Laser Design is a computer aided manufacturing (CAM) software package specially dedicated to GF Machining Solutions' Laser machines to create machining programs for Laser textures, including Laser blasting. The operator tells the AgieCharmilles Laser texturing machine the position of the grain, its density, and the organization of the Laser points to be applied to workpiece surface. This makes it extremely simple to import a computer-aided design (CAD) file, transform it to a 3D map and apply the desired, pre-mapped texture to the workpiece. Laser Design then tells the AgieCharmilles Laser texturing machine the density of the Laser points to be applied to the workpiece surface. Many programming hours are saved.

Process stability and uniform quality across every design reproduction are also significant challenges posed by conventional surface texturing methods like sandblasting. Sandblasting's productivity-impeding drawbacks in mold and die applications include its inexactness, making repeatability and homogeneity impossible; Its manual nature can result in inconsistent quality and scrapped parts, and finding and using the right grain of sand; masking portions of the workpiece and—often—the need for a third-party sandblaster, adding days to the finishing process. With GF Machining Solutions AgieCharmilles Laser texturing solutions, a mold can be textured in two days—no masking, hand polishing or third parties required.

The solution

Complete control of the texturing process is beyond the capabilities of conventional texturing methods, resulting in the risk of human error, scrapped molds, or poor-quality end products. GF Machining Solutions' Pattern Texturing Laser (PTL) surface characterization overcomes those issues by taking into account a wide variety of spatial and hybrid parameters, including average groove width (Rsm), texture aspect ratio (Str) and interfacial area ratio (Sdr). By controlling these surface characteristics, Laser blasting can ensure perfect homogeneity and regularity, making it a revolutionary solution.

GF Machining Solutions' Laser advances are expected to enable a revolution in functional surface textures by, for example, generating the best surface finish according to both the characteristics of a mold and the injection material. This increased process control will make it possible to boost productivity and end-product quality.

GF Machining Solutions' ongoing applied research is already demonstrating that appropriately selected Laser structures can reduce injection cycle times with several types of plastic without compromising surface quality.

LASER S series

LASER S series. Innovative texturing. Accelerated productivity.

The AgieCharmilles LASER S 1000 U five-axis Laser texturing machine enables unparalleled creative freedom for industrial product designers by delivering innovative texturing and accelerated productivity.

Existing surface texturing technologies such as chemical etching limit industrial designers in terms of productivity (depending on the application and complexity), predictability, and ecological sustainability targets. At the same time, emerging technologies are slow and do not deliver the high-quality finishes targeted by industrial designers and their customers.

The challenges

Chemical etching has long been the favored method of applying surface textures to high-value parts and tools like injection molds, but manual etching entails the use of corrosives (acids) and time-consuming workpiece masking (selectivity) to carry out the layer-by-layer etching process. At the same time, this process is a manual one, making it both labor-intensive and subject to human error. Because etching depends on a chemical reaction, straightness and consistency can be difficult to achieve and maintain across production runs, and users can encounter challenges from accumulative tolerances or thicker materials that may require sacrificing dimensional tolerance for etching to be successful.

The solution

To authoritatively assess the capabilities of its new LASER S range of Laser texturing solutions, GF Machining Solutions challenged Switzerland-based international creative studio and design consultancy Stojan+Voumard to design a concept product integrating a variety of surface characteristics from simple to extremely complex. The resulting design, a highly stylized 120 x 120 x 110 mm bird to be executed in stainless steel and aluminum, incorporated distinct machining challenges—including a 30-degree undercut from the front of the design that extends to the under- and inside of the workpiece, double curved surfaces, and difficult-to-achieve seamless transitions between elaborate surface geometries.

A result from the latest Laser innovation

The LASER S 1000 U brings together increased thermostability, a larger marking field, flexibility to easily switch from one Laser source to another to adapt the texturing process to the application at hand, and Flexipulse technology to tune Laser parameters down to the finest detail and achieve the right quality-to-speed ratio.

- Temperature variations are a critical factor in a stable Laser operation and the LASER S series' Laser head ensures the thermostabilization to keep the Laser beam spot stable at the desired position throughout the machining operation. This characteristic ensures consistently high machining quality, even on molds and high-value workpieces requiring very long machining times.
- Productivity is increased mainly by the LASER S machine's high-speed 3D scanning system and Smartpatch technology, which reduces machine movement to the minimum. Available high-end lenses further increase quality and enlarge the machine's marking field.
- Because the LASER S series machines accommodate two Laser sources in one solution, users' flexibility is increased and they gain the agility to easily adapt their Laser machining processes to the applications at hand. For example, a 30-watt Flexipulse can be used for demanding high-quality applications and switched for a 50-watt or 100-watt Laser for efficient Laser machining.

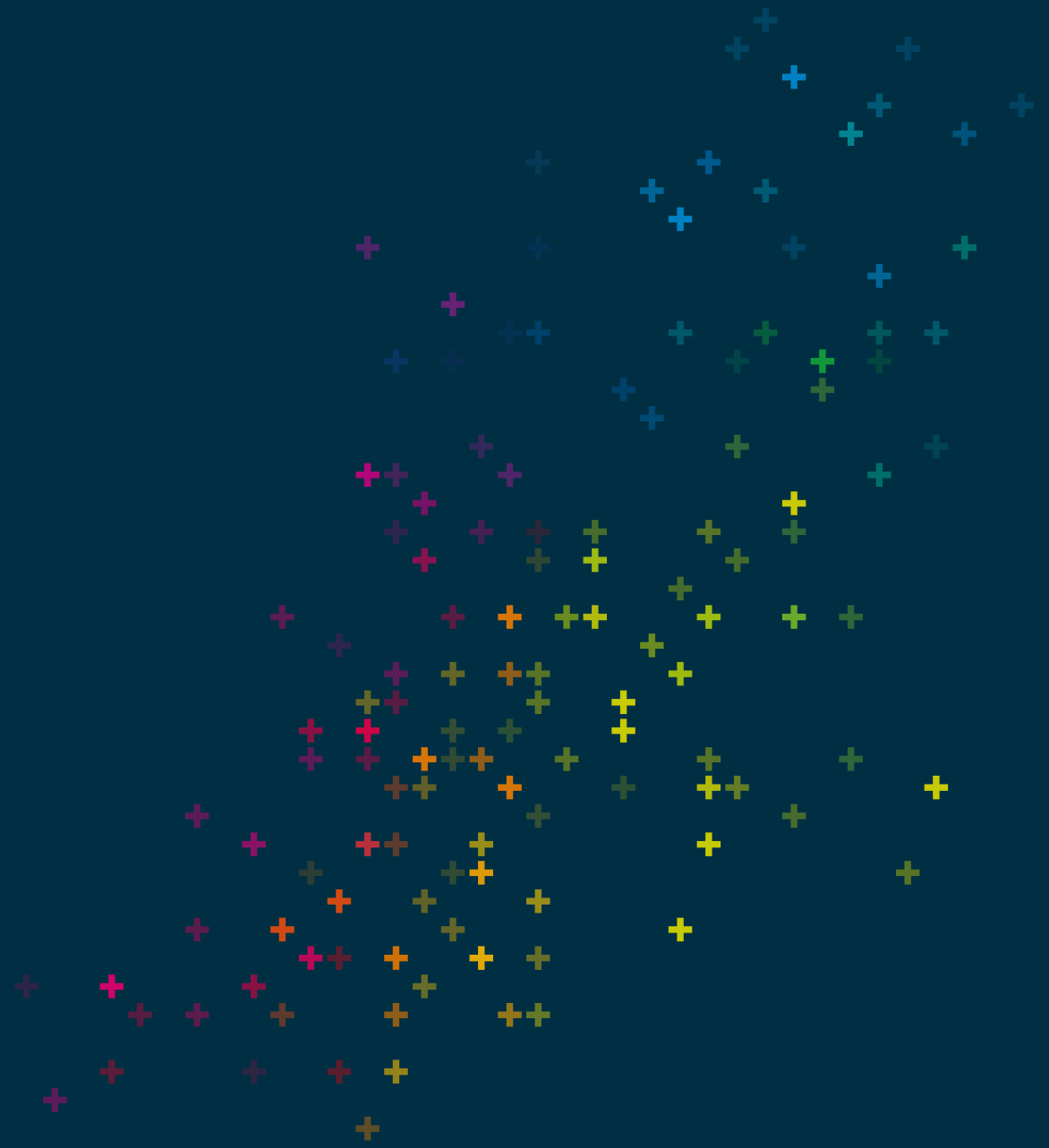
The design tested required geometrical patterns with no deformation whatever the surface shape and a texture depth of 30 microns. The objective of integrating so many demands in a single workpiece was to push the LASER S machine past typical industrial design demands and prove its ability to tackle extraordinary complexity. Such complexity presents significant machining challenges for standard laser texturing machines that split textures randomly by a patch; each texture feature generates machine movement, possible thermal changes and, therefore, quality deviations. With GF Machining Solutions' Smartpatch technology and the unique Laser head of the LASER S, each texture detail is started and finished in a single movement. This reduces the number of patches executed and avoids the risk of positioning deviations and consequent quality deviations.

GF Machining Solutions

At a glance

We enable our customers to run their businesses efficiently and effectively by offering innovative Milling, EDM, Laser, Laser micromachining, Additive Manufacturing, Spindle, Tooling and Automation solutions. A comprehensive package of Customer Services completes our proposition.

www.gfms.com



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