An all-purpose laser engraving system

Jan Breiholdt

Cellaxy defines the high end in gravure, while also meeting high embossing and coating requirements. The Cellaxy laser system's universal design enables adjustments to be made based on intelligent algorithms without any mechanical changes. This is designed to ensure the high-power, high-quality laser beam can be utilized to optimum effect in any application.

Cellaxy uses up to two fiber lasers in the 600 W performance class. The platform design means it can optionally be equipped with any type of laser.

As a result, Cellaxy is also prepared for future developments such as the high performance classes of nano and pico lasers. The necessary preparations are in place for Cellaxy to engrave the HelioPearl laser-engravable monolayer, too.

Cellaxy is a premium packaging gravure output machine and represents the benchmark for high-definition gravure (HD Gravure). Wherever flawless results are required for flexible packaging, labels, cigarettes, packaging for the cosmetic and pharmaceutical industries or decor printing applications, Cellaxy shows its strengths.

Cellaxy lasers with a resolution of up to 2000 l/cm (5080 dpi). The finer tonal gradations produce more nuanced, higher-contrast contone than in stylus engraving.

Cellaxy engraves linework and text in etching quality

Source: Hell Gravure Systems

Linework and text

Cellaxy engraves with a laser spot size of 10 µm and a resolution of up to 2000 l/cm (5080 dpi) for contour definition in etching quality. In addition, the special algorithm for optimizing edge cells produces smooth, closed contours in print.

When engraving with Cellaxy, the screen and screen angle have no effect on the speed of the laser. This means Cellaxy can make the most of its superiority regardless of job structure, imaging a gravure cylinder up to three times faster than an 8 kHz standard engraving machine.

Contone

As a result of finer tonal gradations, Cellaxy produces contone that is even more nuanced and shows even higher contrast than in stylus engraving. Either a diamond-shaped or a hexagonal screen can be used for contone reproduction.

Helio-compatible calculation of contone screens ensures cylinders engraved conventionally and lasered with Cellaxy can always be used together for printing.

Cellaxy works in tandem with CellCreator. This unique software makes it possible to adapt contone screens to specific printing conditions, which also creates smooth vignettes on aluminum and perfect smoothness with metallized inks.

Embossing

There is a clear trend toward products with increasingly elaborate finishing. The demands relating to fineness and detail are particularly high for embossing techniques.

As a universal laser for the direct structuring of metal surfaces that is capable of engraving virtually any geometrical shape on a cylinder surface, Cellaxy is ideal for many of these applications, producing precise embossing forms with exceptional cost-efficiency.

Cellaxy performs fully automated multipass engraving with an engraving depth of up to 1000 µm. It does so on a variety of materials, including copper, zinc, steel and aluminum. Both 2D and 3D embossing forms are produced in the highest possible stepless and seamless quality.

The results achieved with Cellaxy embossing processes are highly impressive thanks to long-lasting tactile features and high attention to detail. This applies equally to micro-embossing over large areas and background textures.

Coating

Cellaxy can also be used for coating applications, e.g. in the engraving of transfer rollers, at low cost. Coating application systems are implemented as inline solutions or as stand-alone coating systems.

The corresponding transfer rollers for primers, lacquers and adhe-

Cellaxy produces contour that is even more nuanced and shows even higher contrast

Source: Hell Gravure Systems

sives are screened with Cellaxy in hexagonal form or with hashes.

Three laser modes

The Cellaxy fiber laser can produce a steady, uninterrupted laser beam and also allows users to pulse the beam. On this basis, HELL has created three different operating modes for Cellaxy:

- **Continuous**

In this mode, the laser output is continuously modulated between 0 and 100 %.

Practical applications include decorative gravure and LAMS etching masks.

- **Pulse**

In this mode, the output-modulated laser beam is pulsed on and off continuously.

Doing so results in excellent removal characteristics. Areas of use include printing applications and high-precision embossing.

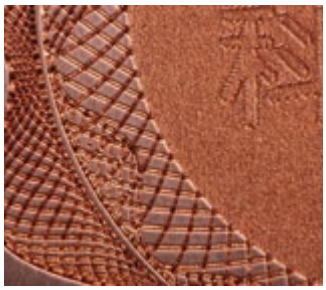
- **Interleave**

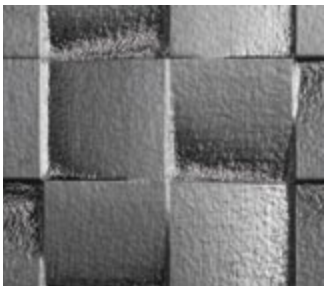
Utilized in conjunction with pulse mode, this mode switches the output-modulated laser beam back and forth between two alternate tracks. In addition to boosting performance, it also ensures good removal characteristics and is used, for example, in standard embossing applications.

"Cellaxy performs fully automated multipass engraving with an engraving depth of up to 1000 µm."

High laser beam quality and intelligent algorithms

Cellaxy is a universal laser tool for the direct engraving of metal cylinders. A variety of integrated software-based functions enable it to adapt to the relevant application.





Source: Hell Gravure Systems

Cellaxy engraves stepless and seamless 2D and 3D embossing forms

This means Cellaxy meets all kinds of requirements relating to applications such as the packaging, tobacco and automotive industries, wood decors and technical cylinders.

Cylinder compensation

Cellaxy compensates for suboptimal cylinder properties as far as possible. For example, it is equipped with an integrated system for balancing.

Cellaxy is also fitted with a series of sensors to check the properties of the cylinder to be lasered and interrupt cylinder run-up in the case of inadequate concentricity or balancing quality.

The cylinder's conicity is checked using geometrical cylinder measurement and the focus can be adjusted during engraving if necessary.

Edge cells

Due to the process, a gravure cylinder must also be screened in full tone in order to provide the doctor blade of the printing unit with sufficient contact surface. On inclined contours, this often creates small cells that do not print out and make the contour appear less smooth. Merging non-printing cells with neighboring ones improves the printing behavior and makes the contour look smooth again.

SuperCell

SuperCell is an algorithm that creates smooth contone transitions in direct laser engraving. Based on dithering technology in CellCreator, it ensures perfect, smooth vignettes.

Multipass

The maximum engraving depth of each laser pass depends on the material and application. For example, it is approximately 11 µm in the case of steel and around 30 µm in the case of copper. Comprising several engraving passes, the multipass process is used to achieve larger engraving depths. The special feature of this process is that the direction is reversed automatically

Source: Hell Gravure Systems

Contour with conventionally lasered edge cells

Source: Hell Gravure Systems

Merging edge cells for an improved printout

Cellaxy – the equipment concept

- **One or two lasers**

One feature exclusive to Cellaxy is the use of up to two fiber lasers in the 600 W performance class, making it the most productive direct laser on the market.

- **Ready for new laser developments**

Cellaxy can be equipped with any type of laser, meaning it is also prepared for the latest developments such as the high performance classes of nano and pico lasers.

- **HelioPearl ready**

Cellaxy has all the necessary preparations to engrave the laser-engravable monolayer. For this purpose, it can be retrofitted in the field with an alternative short-pulse laser.

K.Walter developed HelioPearl to produce a polymer monolayer for eco-friendly, cost-efficient and time-saving cylinder coating.

- **Separate lowered working area**

A shutter separates the machine's user-friendly lowered working area from the laser head. The extraction, lubrication system and wet chamber have all been optimized based on the latest developments.

- **Integrated brush**

The integrated brush head is activated as required to optimize surface cleaning – during multipass processes, for instance.

- **Temperature-controlled bearing blocks**

The cylinder temperature needs to be kept constant throughout to ensure high-precision lasering.

Cellaxy therefore regulates the temperature of its laser chamber and bearing blocks.

- **Two machine sizes**

Cellaxy is available in two different sizes geared to customer requirements.

between each engraving pass, which alternates the cylinder's feed direction and direction of rotation. The focus position is automatically adjusted to suit the relevant engraving depth. The multipass process can be used for engraving depths of up to 1000 µm.

Stepless embossing

Cellaxy is controlled by 8-bit grayscale TIFF data. The engraving depth follows the grayscales in the image signal. In the multipass process, the original 8-bit grayscale TIFF file produces an n-fold number of new 8-bit grayscale TIFF data. Each individual file is used to control one slice. In each slice, the engraving depth follows the grayscales in the image signal. The transition from one slice to the next is calculated using algorithms to ensure a stepless result. This means Cellaxy can produce stepless 3D engravings with ultrafine resolution up to a maximum engraving depth of 1000 µm.

Seamless finish

For seamless engraving of printing and embossing forms, Cellaxy benefits from algorithms that adjust vertical motif structures to the continuous feed's helical gradient on the fly. Several algorithms are available, depending on the application, with the result that joints are no longer visible.

Reproduction

HELL provides its Cellaxy customers with a set of tried-and-tested Helio-compatible screens as standard. This enables users to immediately image linework and contone cylinders that can easily be combined with electromechanically engraved cylinders.

Moreover, CellCreator makes it possible for users to edit pre-defined screens or develop their own screens. This includes various cell geometries (e.g. hexagon or diamond) plus a screen structure that can be varied in terms of either depth or area as required (e.g. semi-autotypical, conventional or autotypical).

The possibility to define a separate cell description for each density value is unique. CellCreator enables users to adapt gravure cylinders very specifically to customer requirements and fully utilize the potential of direct laser engraving. This results in perfect contone reproduction and a linework resolution of up to 2000 l/cm (5080 dpi).

Mixed operation

Helio-compatible contone reproduction is always ensured with Cellaxy, meaning that cylinders engraved conventionally and lasered using Cellaxy can be used together for printing.

Furthermore, there is no difference between the requirements relating to the copper surface of conventionally engraved and lasered cylinders.

Conclusion

With the Cellaxy C500, HELL Gravure Systems has developed a flexible concept for high-quality direct laser engraving of gravure cylinders and embossing forms that can be configured to suit specific customer requirements.

This platform offers users complete investment security, regardless of laser source or the cylinder/roller surface to be engraved.

High-performance gravure

Stylus engraving

8 kHz	8 kHz Twain	12 kHz	12 kHz Twain
60 mins	41 mins	37 mins	25 mins

Direct laser engraving

1-beam	1-beam interleave	2-beam	2-beam interleave
109 mins	55 mins	55 mins	27 mins

Comparison of the average engraving time for a sample cylinder set: 0.7 m², 6 colors, screen 70, screen angle 0,0,2,2,3,4, helical engraving, 25% fast crossfeed, Twain efficiency factor 1.5, no preparation time

High-performance embossing

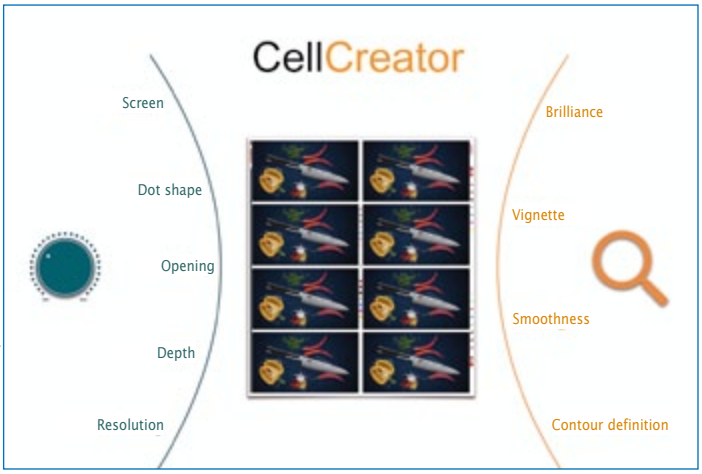
Copper

1-beam	1-beam interleave	2-beam	2-beam interleave
40 h	21 h	21 h	11 h

Steel

1-beam	1-beam interleave	2-beam	2-beam interleave
57 h	29 mins	29 mins	16 mins

Comparison for engraving an embossing cylinder: 0.7 m², 500 µm depth, no fast crossfeed, no preparation time
Copper: 25 × 20 µm slices, steel: 42 × 12 µm slices



Source: Hell Gravure Systems

CellCreator transparently maps the Cellaxy production parameters onto the print result