INSIGHTS

ISSUE 1 2015

INCREASING EFFICIENCY WITH INTELLIGENT CONTROL

HEIDENHAIN TNC 640

MORE RELIABILITY IN PLANNING, GREATER EASE OF USE

The new “Hermle Automation Control System” (HACS)

SUCCESSFULLY INTRODUCED

Generative manufacturing with MPA technology

HERMLE

milling at its best

Preface

A highly successful 2014 is now behind us and the impetus from the old year has carried us into a running start for 2015. Demand for our 5-axis machines has been and remains high, despite financial troubles around the world which are a continual source of concern for our customers. So it is all the more important to remain alert and recognise changes early on when they come to be able to react accordingly.

As previously announced, we once again increased sales for the past business year compared to 2013. Especially in the last quarter, our entire team demonstrated which peak performance it is capable of. We not only delivered the machines on time, we simultaneously moved HLS (Hermle-Leibinger Systemtechnik GmbH) and assembly for large machines into the buildings which had just been completed. Our capital expenditures in new assembly and office buildings are now successfully completed.

In the current year we will be investing further in developing our worldwide service network. Highly qualified and motivated service engineers plus rapid availability of spare parts are the fundamental prerequisites for successful worldwide sales.

At present we are in the midst of intensive preparations for the Open House that will take place in April. For years this event has been the most important platform for presenting our entire product range as well as new products in our portfolio. This year we will be presenting the new generation of the well-known C 50, C 52 U and C 52 U MT, our recently developed software tool HACS (Hermle Automation Control System), and also the latest version of the MPA (Metal Powder Application) process developed by Hermle Maschinenbau GmbH.

This generative manufacturing processes, often referred to as 3D printing technology, offers a wide range of options in many different applications. To find out more about the MPA process, please talk to our specialists.

You are cordially invited to visit us at the Open House – we are looking forward to interesting discussions.

Sincerely yours,

Franz-Xaver Bernhard
Director of Sales, Research and Development

HERMLE AG

OPEN HOUSE

GOSHEIM | 22.04. – 25.04.2015

THE COMPANY EVENT MOVES TO A NEW LEVEL

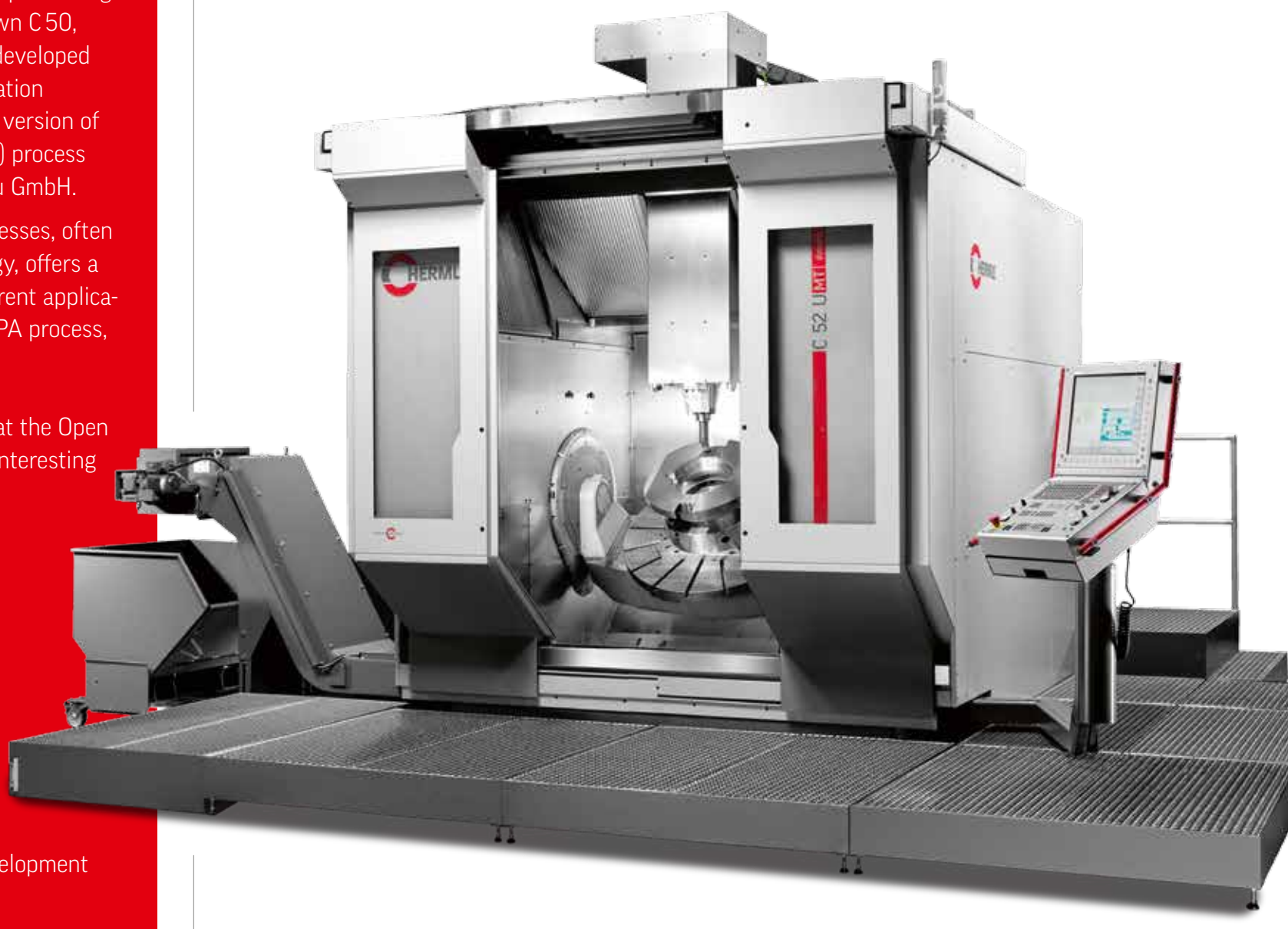
"Exciting to the end". This year again Hermle is inviting industry professionals to its Open House in Gosheim. Over 30 exhibitors in clamping technology and another 20 exhibitors in CAD/CAM and control technology will be offering an enormous added value for visitors to the special exhibition, who will find concentrated and focused information about the latest trends and developments in the industry. **www.hermle.de** – We'll keep you up to date.

The new generation – milling and turning at its best – C 52 U / MT

Many factors have to be considered to ensure that a workpiece is manufactured perfectly. For this reason, Hermle has been working progressively on perfecting and optimising the machining process for many years.

Hermle will also be exhibiting an advanced version of the C 50 U/ MT at the Open House. This highly dynamic machining centre C 52 U / MT is consistently designed with 5-axis/5-side machining in mind. Features galore to ensure high-precision, economical parts production. Numerous automation solutions extend the application range many times over.

Combined milling and turning in up to five axes. The special MT concept of the machine makes this possible! All rotational machining operations can be performed even with the table swivelled. The table can be loaded with workpieces up to 2000 kg.



EXHIBITS

EXHIBITS IN THE TECHNOLOGY AND TRAINING CENTRE

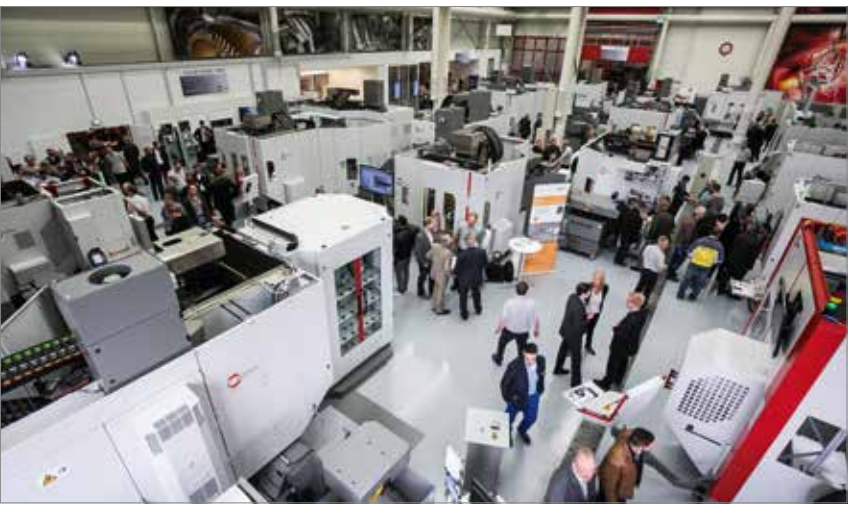
1 x C 12 U
1 x C 12 U with robot system RS 05
1 x C 400 U
2 x C 22 U
1 x C 22 U with pallet changer PW 150
1 x C 32 U with handling system IH 60
4 x C 32 U
1 x C 32 U with robot system RS 2 combination
+ additional magazine single
4 x C 42 U
2 x C 42 U MT (Mill/Turn) + additional magazine single
1 x C 52 U MT (Mill/Turn)
1 x C 60 U MT (Mill/Turn)

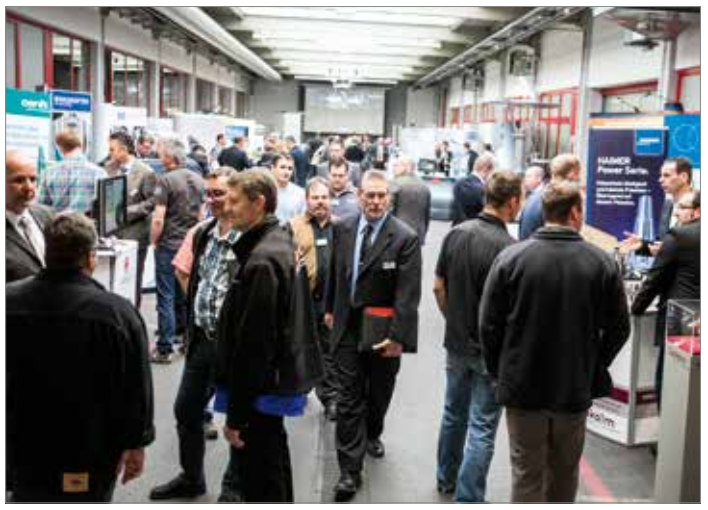
EXHIBITS OPERATING UNDER PRODUCTION CONDITIONS IN OUR MANUFACTURING PLANT

1 x C 1200 V (high-precision manufacturing)
1 x C 12 U with pallet changer PW 100
2 x C 40 U with robot system RS 3
1 x C 42 UP MT with pallet changer PW 850
+ additional magazine single
1 x C 50 UP MT with pallet changer PW 2000
2 x C 60 UP with pallet changer PW 3000
+ additional magazine double

EXHIBITS IN OUR SERVICE CENTRE

1 x C 22 U
1 x C 42 U MT (Mill/Turn)





HIGHLIGHTS

- **Premiere** of the new **C 52 machining centre**
- **Premiere** of the new Hermle **HACS pallet management system**
- **Over 30 machines,** some automated in our Technology and Training Centre
- **Hermle expert forum** – Our application technology and training department will be on hand for all questions concerning applications, machine simulations and technical **innovations in control units**
- **Technical presentations** covering a wide range of topics
- Hermle Maschinenbau GmbH will **be present with generatively manufactured** components
- **Live service competence** – Presentation and demonstration of our services
- **Special show featuring clamping technology** – CAD/CAM software with over 50 well-known exhibitors
- **Guided tours** through the production and assembly areas and the new assembly hall for C 52/60 models and Hermle automation subsidiary HLS

OPENING HOURS

WEDNESDAY – FRIDAY	09:00 – 17:00
SATURDAY	09:00 – 13:00

HEIDENHAIN TNC 640: WITH DYNAMIC EFFICIENCY AND DYNAMIC PRECISION FOR HERMLE MACHINES

TNC control units from HEIDENHAIN have proven themselves over almost four decades of daily work on milling machines, machining centres and drilling machines. These control units have been continuously developed and improved over the years. However, the underlying operating concept remains unchanged. These basic principles have also been implemented in the TNC 640, the HEIDENHAIN contouring control system for milling and turning: workstation-orientated programming with graphical support, numerous practically oriented cycles and an operating concept that closely resembles other HEIDENHAIN control units.

The Heidenhain TNC 640 is used in models C 12, C 22, C 32, C 42, C 52 and all MT models of Hermle AG.

dynamic + efficiency dynamic + precision

EXHIBITORS

CLAMPING TECHNOLOGY

- ALBRECHT PRÄZISION GMBH & CO. KG
- HELMUT DIEBOLD GMBH
- EMUGE FRANKEN
- EROWA AG
- GRESSEL AG
- HAINBUCH GMBH SPANNENDE TECHNIK
- ERWIN HALDER KG
- HEMO WERKZEUGBAU
- HOFFMANN GÖPPINGEN QUALITÄTS-WERKZEUGE GMBH & CO. KG
- HWR SPANNTECHNIK GMBH
- INNOTOOL AUSTRIA GMBH & CO. KG
- GEORG KESEL GMBH & CO. KG
- KOHN SPANNWERKZEUGE MECHANISCHE TEILEFERTIGUNG GMBH
- ANDREAS MAIER GMBH & CO. KG
- NIKKEN DEUTSCHLAND GMBH
- NT TOOL EUROPE
- PAROTEC AG
- RÖHM GMBH
- SCHRENK GMBH
- SCHUNK GMBH & CO. KG
- SPREITZER GMBH & CO. KG
- STARK SPANNSYSTEME GMBH
- VISCHER & BOLLI GMBH
- WOHLHAUPTER GMBH

SOFTWARE – CAD/CAM

- CAMPLETE SOLUTIONS INC.
- CAMTEK GMBH
- CENIT AG
- CG TECH DEUTSCHLAND GMBH
- CIMCO A/S
- CONCEPTS NREC
- DELCAM GMBH
- INFOBOARD EUROPE GMBH
- JANUS ENGINEERING GMBH
- OPEN MIND TECHNOLOGIES AG
- SESCOI GMBH
- SOLIDCAM GMBH
- TEBIS AG
- UNICAM SOFTWARE GMBH

CONTROL TECHNOLOGY

- DR. JOHANNES HEIDENHAIN GMBH
- SIEMENS AG

OTHERS

- AIRTURBINE SPINDLES
- BENZ GMBH
- BIG KAISER GMBH
- BLUM-NOVOTEST GMBH
- FRAKO POWER SYSTEMS GMBH & CO. KG
- HAIMER GMBH
- KELCH GMBH
- MIMATIC GMBH
- M & H INPROCESS MESSTECHNIK GMBH
- RENISHAW GMBH
- STAABTEC OPTISCHE MESSTECHNIK
- CARL ZEISS INDUSTRIELLE MESSTECHNIK GMBH
- E. ZOLLER GMBH & CO. KG

HEIDENHAIN

Increasing efficiency with intelligent control

MILLING AND TURNING WITH ONE CONTROL UNIT: HEIDENHAIN TNC 640

The TNC 640 combines the functions of the proven iTNC 530 with the new **Dynamic Efficiency** and **Dynamic Precision** software packages for models C 12, C 22, C 32, C 42, C 52 and all MT models. Additional special turning cycles are integrated into MT models such as roughing, finishing, grooving and threading. Easy to switch from milling to turning mode.

The TNC 640 is integrated into the ergonomic control panel, that can be adapted +/- 100 mm in height for user preference. The 19" screen can also be tilted up to 30° degrees to adjust it to specific local conditions. The practical, slide-in tray offers the operator an additional storage surface for every day use.

INTELLIGENT MACHINING – DYNAMIC EFFICIENCY

HEIDENHAIN's **Dynamic Efficiency** products feature innovative TNC functions that help users arrange heavy-duty machining and roughing more efficiently while also making the process more reliable. The software functions provide support for machine operators and also make the production process more efficient.

- **ACC** – Active Chatter Control – Controller function for reducing the process induced rattle. This helps you reduce the load for the machine and extend the service life of the tool.

- **AFC** – Adaptive Feed Control automatically controls the feed rate of the TNC – depending on the relevant spindle output and other process data. Advantages: Optimises machining time and tool monitoring, protects machine mechanics.

- **Trochoidal milling process** – Advantage: Machine any grooves completely and highly efficiently, especially when milling high-strength or hardened materials.

FAST, RELIABLE AND CONTOUR-TRUE MACHINING – DYNAMIC PRECISION

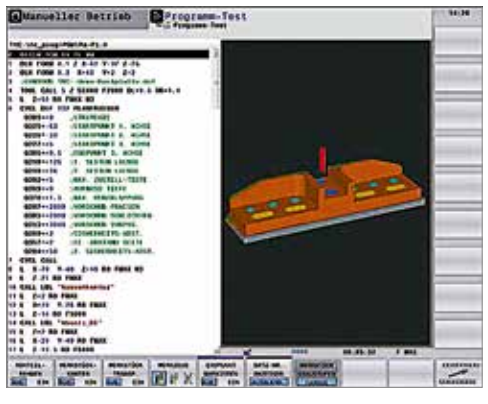
HEIDENHAIN's **Dynamic Precision** products include milling solutions for considerably improving the dynamic accuracy of a machine tool.

- **CTC** – Cross Talk Compensation for position deviation due to machine backlash between the measuring device and TCP, which improves accuracy during acceleration phases.

- **AVD** – Active Vibration Damping, which results in improved surface quality.

1 he keys are easy and comfortable to use. LEDs provide information about activated machine functions.

2 Storage media can be connected to the control panel quickly and easily via the USB-2.0 interface.



3 User interface: Along with its bright appearance, the display focuses on easy operability for users. Different area are clearly separated from each other and icons provide information about the different operating modes.

More certainty in planning, greater ease of use with HACS

The new "Hermle Automation Control System" (HACS) is a system for controlling and monitoring Hermle machines that have been automated with pallet changers. HACS makes production planning easier, including tool insert calculation.

SUPPORTED SYSTEMS

Handling:

PW 100 – C 12
PW 150 – C 22
PW 250 – C 32
PW 850 – C 42
PW 2000 – C 52
PW 3000 – C 52 / C 60
All Hermle pallet changers
No RS systems

Control units:

Heidenhain TNC 640 –
C 12 / C 22 / C 32 / C 42 / C 52 + all MT models

Heidenhain iTNC 530 with HSCI –
C 22 / C 60

Siemens S 840 D sl –
C 22 / C 32 / C 42 / C 52 / C 60 + all MT models

The additional control panel – adapted to the pallet changer setup station.

An additional pivotable control panel has been adapted to the pallet changer setup station (see illustration). The user interface – easy and intuitive to operate with drag and drop makes day-to-day production tasks easier. As with other previous Hermle development projects, they will first be tested in our internal machining manufacturing under production conditions until they are ready for series production. HACS will be used with all Hermle pallet changers. Like its predecessor the PMC system, it can be used for all control units. Newly ordered machines (with pallet changer) will have HACS already installed.

ADVANTAGES OF HACS

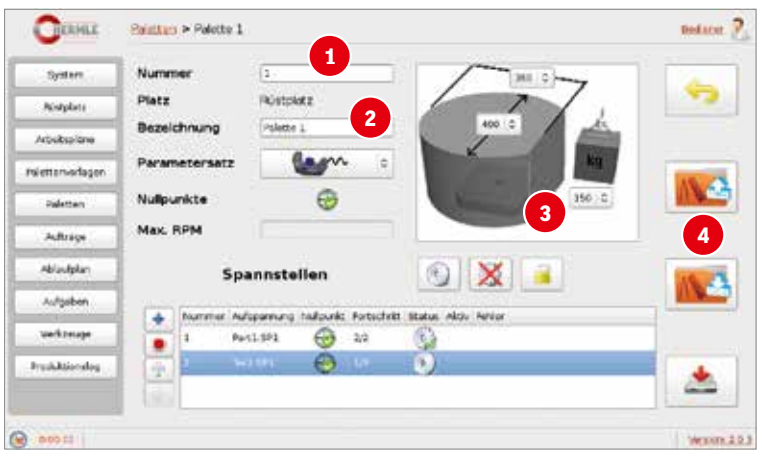
The operator has the tasks relevant for him in sight at all times. This ensures practically failure-free production. The clear structure and simple layout of the system help to prevent errors. In addition, HACS can be used without a Windows computer and requires no cost wearing interfaces. HACS is fully integrated into its work environment.

The intuitively operable software shows all relevant data at a glance, both at the setup station and machine control: system overview, work plans, pallets, schematic diagram, tasks and the tool table.

All new workpieces are automatically entered in order in the schematic diagram when they are set up. After orders are defined, the priority of a workpiece and with it the order of machining can be altered at any time. It is also possible to resort the schematic diagram using drag and drop.

HACS AT THE 2015 OPEN HOUSE

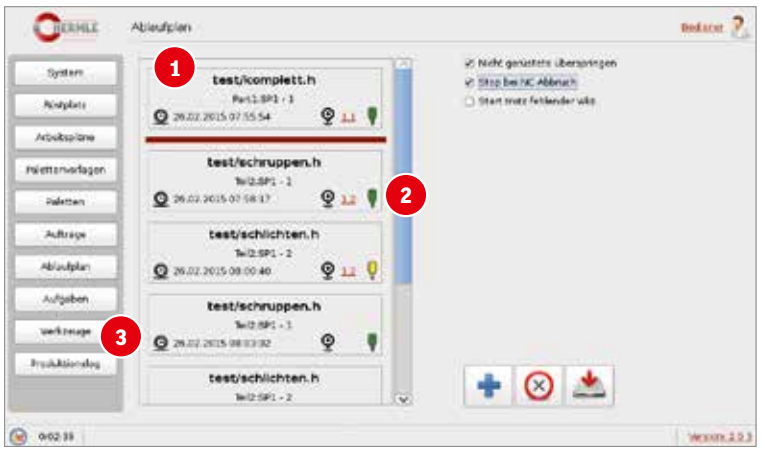
A PW 150 pallet changer and a IH system will be equipped with HACS for the Hermle Open House. According to current plants, however, IH systems will only be optionally equipped with HACS, unlike the pallet changers.



PALLET DATA

1 Unique physical number.
2 User-defined name for templates.
3 Pallet dimensions.
4 Loading / saving templates.

A look at the pallet changer PW 250 with setup station (left), 4x storage (rear), the traversing unit (front) and the machine working area (right).

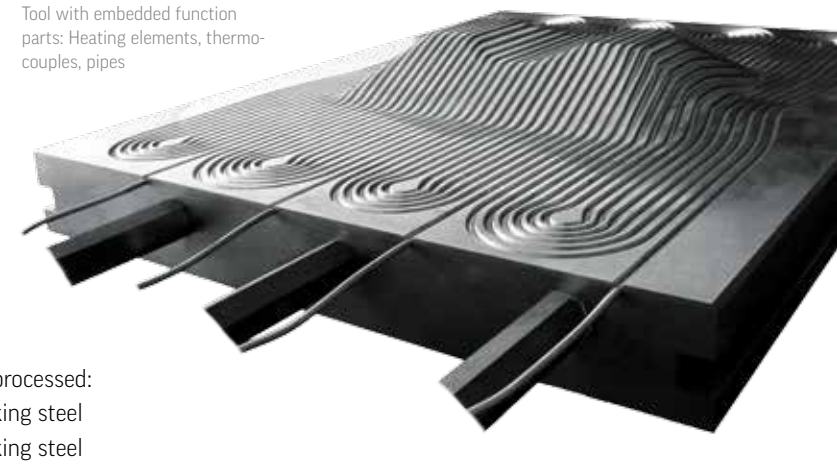


SCHEMATIC DIAGRAM (PLAYLIST)

1 Chronological sequence. Drag and drop to adjust.
2 Tool status.
3 Starting time.

Successfully introduced:
Generative manufacturing with MPA tec

For two years now, Ottobrunner Hermle Maschinenbau GmbH (HMG) – a wholly owned subsidiary of Hermle AG – has been offering the MPA (Metal Powder Application) process, a technology with potential comparable to 3D printing technology, but for metallic materials. The technology has mastered initial applications with gusto (see the brief user report to the side).

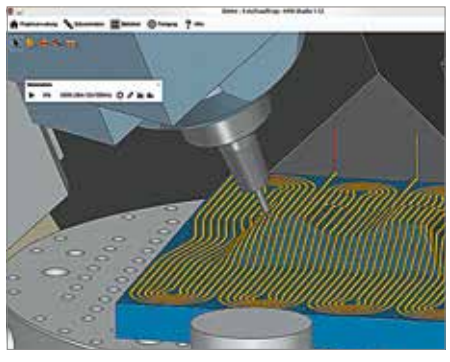


Tool with embedded function parts: Heating elements, thermo-couples, pipes

As a service provider in generative manufacturing, HMG not only has extensive theoretical knowledge and many components from various industries tested under production conditions, but now also concrete, practical experience in manufacturing. Hermle has succeeded in developing a working process for generative manufacturing of parts and placing it on the market. The goal is to continue optimising the system and take advantage of the possibilities it offers: For all parts that cannot be produced, or can only partly be produced by machining.

FUNCTIONAL PRINCIPLE OF THE PROCESS

MPA technology is a process to produce parts that can be used under production conditions from metal powder. MPA technology is a thermal spray process for metal powder. The process can be used to produce components in high volumes with almost any inner geometry.



Internal CAM software for planning, simulating and monitoring manufacturing processes

APPLICATION AND CHIP REMOVAL IN ONE MACHINE

Powder particles are accelerated to very high speeds with a carrier gas for material application. Then they are applied on the substrate with a nozzle. The application unit for the metal powder is integrated into a Hermle 5-axis machining centre. In this way Hermle is expanding its proven machining technology to include the diverse possibilities of generative manufacturing.

MATERIAL BUILD-UP AND MACHINING COMBINED

Integrating the application unit into a Hermle 5-axis machining centre facilitates hybrid manufacturing processes with material application and machining combined in just one machine. Material is applied in layers and always as far as can be allowed with the relevant component contours still accessible for milling. After the contours are machined, the process switches back to the application procedure. In this manner a solid body consisting of two or more materials can be built up.

A CAD/CAM software program called MPA Studio developed especially for the MPA process is used to create programs with alternating application and machining paths. It allows the layer-by-layer analysis and machining of the component geometry needed to build up the material. The ability to simulate the complete process as well as quality assurance functions for checking the finished component make the software a flexible and versatile tool for MPA technology.

Tool insert with integrated copper cores. Generative manufacturing with two materials makes it possible to integrate heat dissipation via cooling channels and copper cores. Materials: Hot-working steel 1.2344 and pure copper.

MATERIALS – METAL POWDER

The initial materials for the application process are metal powders with grain size from 25 to 75µm. Inner geometries and relief cuts can be implemented by using a water-soluble filling material. It is washed out of the component after the manufacturing process is completed, leaving the required hollow areas.

The following materials can be processed:
- 1.2344 temperable hot-working steel
- 1.2367 temperable hot-working steel
- 1.4404 stainless steel
- Heavy metals (pure copper, bronze)
- Light metals (titanium, aluminium)
- Filling material for inner geometries (water-soluble)

WORKPIECES

The MPA process can be used to manufacture temperable tools and mould inserts with internal cooling channels or an integrated heating element. Round components with these requirements are also possible.

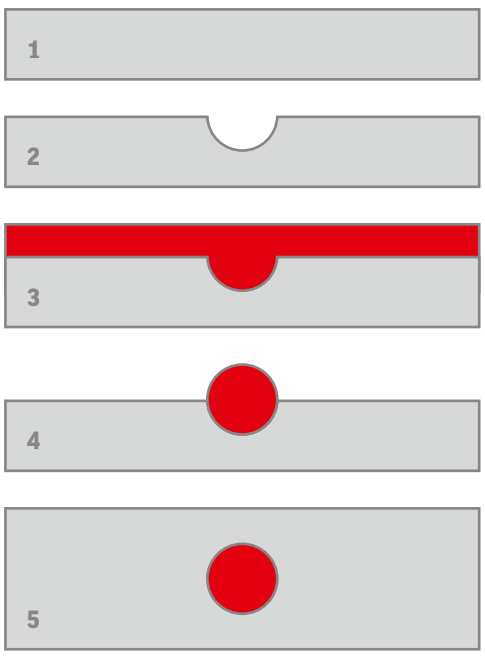
MATERIAL ANALYSIS AND QUALITY CONTROL

Manufacturing high-quality components requires optimum coordination of process parameters for each metal powder that is used. The properties of the resulting microstructure are determined through extensive series of tests.

In addition to pressure and tensile tests of the components, grindings are also prepared for examination under a light microscope. Information about particle and layer adhesion, porosity and any inclusions is derived from magnifications of up to 1000X.

"COOLING CHANNEL" AS AN EXAMPLE OF THE MANUFACTURING PROCESS

The individual processing steps can be followed on the right under "Brief explanation of MPA technology".

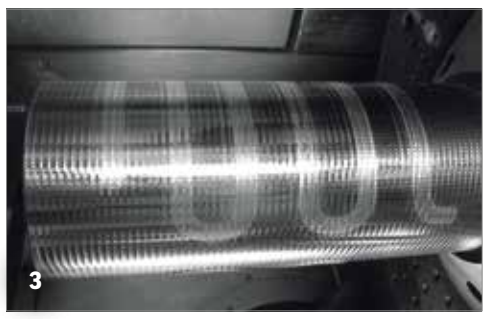


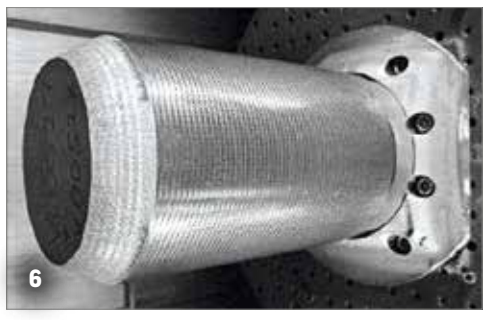
FURTHER INFORMATION:

www.hermle-generativ-fertigen.de

"ROTATING PART" AS AN EXAMPLE OF THE MANUFACTURING PROCESS

The individual processing steps can be followed on the right under "Brief explanation of MPA technology".





chnology

AN OVERVIEW OF THE PROCEDURE

A BRIEF EXPLANATION OF MPA TECHNOLOGY

1 SEMI-FINISHED PRODUCT
- As initial material

2 MILLING
- Material is removed from the semi-finished product
- The part can also be provided in this state by the customer

3 APPLICATION
- Fill milled initial material with (water-soluble) carrier material

4 MILL CARRIER MATERIAL TO SHAPE
- The (water-soluble) carrier material is milled into shape

5 APPLY CONSTRUCTION MATERIAL
- Application of tool steel on the surface

6 DISSOLVE CARRIER MATERIAL
- The (water-soluble) carrier material is removed from the workpiece

COOLED TOOL INSERT

The 5-axis configuration of Hermle machines with MPA technology makes it possible to set up cooling close to the contour on the freeform surface of a blank. Material: Hot-working steel 1.2367.

ACCENTUATING KEYPOINTS WITH TECHNICAL INNOVATIONS

Left to right: Klaus Holzer, Master Mould Maker responsible for the MPA project, Gerhard Gorbach, Manager of Equipment Manufacturing, Helmut Böhler, Department Milling Master and the machine operator Mathias Huf, all from Julius Blum GmbH, plant 3 in Höchst/Vorarlberg (Austria).

Generative manufacturing with MPA technology in practical applications – a success for technology and product innovators Julius Blum GmbH and Hermle AG!

A PARTNERSHIP BUILD ON THE AWARENESS OF BOTH PARTNERS' STRENGTHS

"Whenever possible and practical, we use the latest technologies and processes. We approach these projects with an evaluation process on three levels", explains Gerhard Gorbach, Manager of Equipment Manufacturing at Julius Blum GmbH in Höchst, Austria. The most recent success in this vein was the presentation of the new MPA technology for generative manufacturing of components for injection moulding as well as die cast tools and moulds.

IMPRESSIVE PRACTICAL TEST: MOULD CAVITIES MANUFACTURED WITH MPA

A "cover flap" plastic part was chosen as reference project by Gerhard Gorbach, Manager of Equipment Manufacturing and Klaus Holzer, Master Mould Maker responsible for the generative manufacturing/MPA project. "Until now we had to manufacture tools for this purpose from two parts which were then soldered together. We were working with multiple injection moulding tools due to the high unit numbers, and they had to withstand an internal pressure of 1000 bar and quite high cycle frequencies for moulding the cover flaps, which were not a simple matter. So there were repeatedly signs of wear."

The quality of the injection moulding and increased productivity per time unit (due to continuously controlled cooling, which shortens cycle times) are not the only reasons why senior management at Julius Blum GmbH are very impressed with the MPA technology from Hermle.

The illustration reveals the complexity of a tool insert in the temperature-controlled tool system for continuous cooling during the manufacturing of functionally-integrated, high-quality cover flaps (manufactured using injection moulding).

After the test was completed successfully Gerhard Gorbach remarked: "This technology opens up a whole new series of advantages that are not necessarily apparent at first glance. Generative manufacturing in the form of Hermle's MPA technology promises much potential for Blum in the future, which we will tap together with our partner Hermle."

www.blum.com

Plastic cover flap manufactured with tool inserts using the MPA process.

The **Hermle MPA technology** is a thermal spray process for metal powder used in generative manufacturing for making moulds and tools as well as special machine components. The application unit for generative workpiece build-up with different materials is integrated into a high-performance 5-axis machining centre.

For complete manufacturing of a workpiece, the material application is combined with the precise 5-axis machining technology of Hermle AG using MPA technology. Channels and complex hollow areas as well as undercuts can be implemented using water-soluble filling material that is flushed out at the end of the manufacturing process. Subsequent heat treatment optimises the microstructure of the material and also makes it possible for the customer to choose the component or surface hardness.

Hermle MPA technology is available to Hermle customers exclusively as a complete service and includes consulting, a feasibility check, material examinations, optimisation of parts design, and manufacturing (also with semi-finished product provided by the customer).

USERS.

Read the complete article at www.hermle.de
in the info center / user reports section.

MACHINING IN MANY DIMENSIONS ...

Left Jan Kusters, Managing Director of Kusters Precision Parts and right Geert Cox, Managing Director of Hermle Nederland B.V., in front of the C 50 U high-performance 5-axis machining centre operated as a standalone system for manufacturing large parts such as integral aircraft parts made of aluminium.

KUSTERS | EXPERTS IN PRECISION PARTS

With 5-axis machining know-how, mutually complementary machine working areas and an elevated level of automation, perpetually facing stiff competition and on the path to success.

"EXPERTS IN PRECISION PARTS" – FOR OVER 40 YEARS

From an extended workbench to the manufacturing technology partner: Kusters Precision Parts in Oss, Netherlands, has developed into a sought-after service provider. Kusters Precision Parts offers customers a broad spectrum of manufacturing technologies ranging from milling and turning to electrical discharge machining and grinding. Also included are measurement technology and assembly.

NEW DIMENSIONS OR: "SHOEBOX-SIZED" WORKPIECES WERE YESTERDAY ...

Milling takes up the main part, literally in all dimensions. While Kusters concentrated earlier on workpieces no larger than “shoebox size” (J.Kusters), component dimensions up to roughly 1000 x 1100 x 700 mm pose no special challenges today. That is evident from the current machine park, which has been modernised and expanded again and again in the last 10 years. The same can be said of the level of automation in single-part, small and medium series production. Jan Kusters has always been very aware that he must offer his customers the latest technologies and good prices as well: "Our customers demand reproducible precision from us as well as on-time deliveries plus creative and above all economical solutions. Requirements have risen steeply, not least due to the enormous functional integration in mechatronics, which results in much more complex and functionally integrated workpieces requiring high levels of complexity and accuracy in the µ range.

THE STATED GOAL: THREE-SHIFT MANNED AND UNMANNED OPERATION FOR 168 HOURS OF PRODUCTION PER WEEK

New in the Kusters Precision Parts machine park: two large part machining centres, Hermle type C 50 U and C 50 UP respectively and a C 22 UP for small and medium-sized workpieces. While the C 50 U is designed as a standalone system for universal/flexible and manned machining of large format workpieces, the second C 50 UP is equipped for lightly manned operation with a pallet changer. The same applies to the smaller C 22 UP 5-axis machining centre, which has a type PW 150 pallet changer with 11 pallet spaces.

The C 22 UP features compact dimensions and a spacious working area measuring 450 x 600 x 330 mm (X/Y/Z). It holds 65 tools in the integrated tool magazine and another 87 tools in the additional magazine and has a swivelling rotary table with a diameter of 320 mm. The C 50 U and C 50 UP 5-axis machining centres feature working areas measuring 1000 x 1100 x 700 mm (X/Y/Z). They hold up to 60 tools in the tool magazine and another 41 each in the additional magazine and are equipped with swivelling rotary tables 700 mm in diameter for pallets 800 x 800 mm.

WITH THIS MACHINE PARK KUSTERS PRECISION PARTS NOW COVERS WORKPIECE DIMENSIONS FROM A FEW MILLIMETRES TO ALMOST 1 m³.

Jan Kusters believes his change of strategy has been absolutely confirmed: "Our main strengths earlier were in prototype and single part manufacturing. Thanks to the higher level of automation, today we have that same strength in 5-axis machining and workpiece handling, as well as small and medium-sized series manufacturing. With the Hermle machines we are able to machine almost everything to customer specification and also substitute conventional technologies now and again, for example replacing electrical discharge machining with 5-axis milling, or carbide milling with coordinate grinding, thereby achieving further cost optimisation."

The large working area (1000 x 1100 x 700 mm, X/Y/Z) of the 5-axis machining centre's C 50 UP and the NC rotary table 700 mm in diameter for pallets 800 x 800 mm to hold workpieces weighing up to 2000 kg.

www.kustersexperts.nl

DATES

MTMS BRUSSELS/BELGIUM
25.03.2015 – 27.03.2015

MECSPE PARMA/ITALY
26.03.2015 – 28.03.2015

CIMT BEIJING/CHINA
20.04.2015 – 25.04.2015

OPEN HOUSE
GOSHEIM/GERMANY
22.04.2015 – 25.04.2015

MOULDING EXPO
STUTTGART/GERMANY
05.05.2015 – 08.05.2015

METALLOOBRABOTKA MOSCOW/RUSSIA
25.05.2015 – 29.05.2015

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09.06.2015 – 12.06.2015

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Imprint

Published by: **Maschinenfabrik Berthold Hermle AG**
Industriestrasse 8 – 12 · D-78559 Gosheim
Phone +49 (0)7426 95-0
Fax +49 (0)7426 95-6110
info@hermle.de · www.hermle.de
Editing and design: Udo Hipp
Layout: Südpol. the other agency. · www.suedpol.com
User articles: Edgar Grundler
Photos: Inspirations · www.inspirations.de
Hermle AG · Hermle Kunden
Printed by: Straub Druck + Medien – Schramberg
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