

PRESS RELEASE

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## **Technological highlights at GrindingHub 2022: Focus on automation and digitalization**

### **Technical Report**

Frankfurt am Main/Stuttgart, 28 June 2022. – The new home of grinding technology, GrindingHub, celebrated its premiere in Stuttgart under the banner of "Brings solutions to the surface" from 17 to 20 May 2022. More than 370 well-known manufacturers from 23 countries presented numerous innovations across the entire grinding technology process chain at the trade fair. Manufacturers of cylindrical and non-cylindrical grinding machines, grinding machines for cutting and chipping tools, surface grinding machines, grinding, polishing and honing media as well as clamping and filter systems and grinding oils were represented in considerable numbers at the event. Special exhibition areas such as the GrindingSolutionPark Industry, the GrindingSolutionPark Science and the StartupHub attracted considerable attention. In addition, trend topics such as automation, digitalization and networking were reflected in the exhibitors' portfolios at the event. The main technical highlights of the GrindingHub, including grinding and process technology, tool concepts and interface technology, are presented below.

### **Future-oriented grinding machines in response to increasingly exacting requirements**

Numerous machine innovations were presented at the GrindingHub. These included offerings from well-known manufacturers such as Haas Schleifmaschinen GmbH from Trossingen, Erwin Junker Maschinenfabrik GmbH from Nordrach, Rollomatic SA from Le Landeron (Switzerland), United Grinding Group Management AG from Bern (Switzerland) and Ziersch GmbH from Ilmenau. The trends here include greater cost-effectiveness in production, increased quality even for complex geometries, and redesigned machining strategies.

Grinding machine manufacturer Haas showcased its Multigrind Radical tool grinding machine. This is a complete solution capable of producing both rotary and plate tools. The manufacturer emphasized the overall reduction in non-productive time. A further stand-out feature of the machine is the short changeover times for tools and grinding wheels. The operating concept of the Multigrind Radical includes decoupled operation of the machine.

Another innovation from the Baden-Württemberg-based company is the Multigrind CB XL. It can machine complex workpieces up to 3200 mm in length in compliance with all specifications. Manufacturing in one setup is particularly attractive for manufacturers of large tools, such as spline shafts or gear cutting tools. In addition, the machine is suitable for machining long filigree parts such as aircraft landing gear parts, turbine components, ball screw drives, racks and guideways. This is made possible by the symmetrical design of the Haas Multigrind CB XL, which ensures the necessary stability and rigidity.

Junker, based in Nordrach, Germany, demonstrated a new process for grinding worm shafts from solid using a single-tooth grinding process on a high-speed grinding machine, the Platform 2000 Jumat. Worm shafts are used both in the automotive industry and also in general engineering. They are deployed in various steering systems, parking brakes and variable displacement motors, for instance. The Jumat can also be used to produce workpieces with a similar geometry. Geometry calculation of the single-tooth and multi-tooth grinding wheel means that the grinding medium is precisely matched to the thread form. An electroplated grinding wheel is used for pre-grinding. This is regardless of whether soft or hard materials are being machined. Finish grinding makes use

of corundum wheels to create the final profile of the worm shaft flights. This allows workpieces to be produced with accurate geometries and a good surface finish. Workpieces with a clamping length of up to 300 mm and a swing diameter of up to 80 mm can be machined. Junker claims a 35 percent reduction in manufacturing costs and a 50 percent faster cycle time for this process.

In the tool grinding sector, Rollomatic announced the launch of its new GrindSmart 830XW grinding machine. The design enables the machining of tools in the 0.05 mm to 32 mm diameter range. The machine is equipped with hydrostatic linear slides and linear motor technologies. Rollomatic points to optimizations in the surface finishes and cutting-edge qualities.

United Grinding Group also presented its Blohm Planomat XT Essential, a high-precision surface grinding machine in the entry-level segment. Two further innovations from Studer were on display. The S36 external cylindrical grinding machine is designed for small to medium-size workpieces. It is particularly suitable for use in the construction of vehicles, hydraulic systems, pumps and tools. A special feature of the machine is its acceptance of large grinding wheels with a maximum width of 125 mm and diameters of up to 610 mm. The S36 is equipped with C.O.R.E technology (discussed below).

United Grinding Group also presented the new Helitronic G200 from Walter, which is used for tool machining. This is a compact tool grinding machine with a footprint of less than 2.3 m<sup>2</sup>. It can produce or sharpen rotationally symmetrical tools within a diameter range from 1 mm to 125 mm.

Ziersch is moving into a new production grinding segment with its ZR35 cylindrical grinding machine. Ziersch proclaims the high cutting performance and superior precision of the new machine. It features a control system from Ratingen-based Mitsubishi Electric, making it suitable for oblique grinding. Another special feature of this machine design is the vertical grinding wheel movement instead of the conventional horizontal action. The ZR 35 achieves short cycle times thanks to an oblique grinding arrangement with an angle that is adjustable from plus 6 to minus 10

degrees, and an integrated automatic part change system. The new arrangement was specially developed for the highly rigid CNC axes for this purpose.

### **Innovative grinding wheel concepts and grinding wheel conditioning**

At GrindingHub, numerous grinding wheel concepts from various grinding wheel manufacturers, all aimed at producing changes in micro and macro geometry, were on display. The companies driving these trends include Atlantic GmbH from Bonn, Krebs & Riedel Schleifscheibenfabrik GmbH & Co. KG from Karlshafen and Riegger Diamantwerkzeuge GmbH from Affalterbach.

Atlantic presented a patented multi-layer diamond spherical disk at GrindingHub. It is particularly suitable for machining spheres made of silicon nitride, as used in rolling bearings, for example. It is superior to an electroplated grinding wheel, for example, in that the profile can be adapted to other sphere diameters. It should be emphasized that the new grinding wheel concept is flexible and can be used for large and small batches. The grinding wheel is available in sizes up to an outer diameter of 700 mm.

Krebs & Riedel presented a further newly developed abrasive grain concept of the "Blue Moon Tz" grinding wheel technology. This is a precision-formed abrasive grain with a trapezoidal rod shape that is very sharp-edged and microcrystalline. The new abrasive grain has the special property of developing a very low thermal load in the contact zone. This advantage becomes particularly evident when machining very long contact lengths. Typical applications include creepfeed grinding, raceway grinding and profile grinding of gears with large modules.

Grinding wheel manufacturer Riegger unveiled a world first, the TrippelGrind Brush. This tool system concept makes it possible to combine peripheral grinding with edge rounding, e.g. of indexable inserts, in one clamping. Depending on the application, an exchangeable brush for edge rounding can be attached on the face or circumference by means of two different tool concepts.

Mitsubishi Electric and the Institute of Precision Machining (KSF) at Furtwangen University presented the spark-erosion dressing of resin, hybrid and metal-bonded grinding wheels and

diamond dressing tools on their joint stand. Hard and brittle materials, such as tungsten carbide and ceramics, are often ground using resin bonded grinding wheels. Metal bond grinding wheels, on the other hand, offer much greater dimensional stability. Spark-erosion dressing allows the force-free creation of highly reproducible complex and filigree profile geometries on grinding tools with conductive bonds. The CBN and diamond grains are not directly affected by the spark erosion process, meaning that the method allows their protrusion on the grinding wheel surface to be significantly increased. The metal bond grinding wheels thus have the advantage of raising efficiency levels by a significant factor through higher feeding rates, while at the same time meeting the requirements for consistent dimensional stability and high precision. Another advantage is the considerable increase in tool life. However, a disadvantage of this grinding wheel concept is the complex dressing process. To counteract this, processes have been developed for Mitsubishi Electric's V350 Generator wire-cut EDM machine that open up new cost-effective possibilities for dressing metal bond grinding wheels.

#### **Intelligent interface technology setting new standards in digitalization**

The important topic of digitalization in the context of Industry 4.0 also featured prominently at GrindingHub, an example of which is presented below.

Amada GmbH from Isehara in Japan offers visualized programming solutions for measurement-controlled grinding and the automation of grinding processes. The CGS (Complete Grinding Solution) external programming system represents a crucial link in this chain. It links the functions of optional CNC machine assemblies and stand-alone systems. The CAD data is first imported, and the workpiece is then virtually positioned on the clamping surface of the machine as a solid three-dimensional model. The surfaces to be machined can be selected and then linked to a specific grinding and dressing technology for the respective machining operation. The automatic probe, which can be installed on all Amada machines, and a probe control for structure-borne sound can also be integrated. The measurement positions can be selected by a click of the mouse to generate a grinding measurement program (including measurement compensation) during machining. The automatic probe is also used to synchronize the actual workpiece position and the virtual programming before machining starts. The result is reliable machining with structured

programs and operation, regardless of the machine running time. The CGS solutions range from simple and complex machining to multiple clamping of different workpieces on the machining table and the integration of dividing heads for automatic 5-axis machining. Setup and programming times are significantly reduced. Teach-in functions with program automation, supplemented by structure-borne sound sensor technology, are incorporated in the rapid and intelligent workpiece setup. Integrated in the CGS programming system is the probe control which also influences the machining process. The high workpiece precision does away with the need for a second check during machining. Dimensions are checked on the machine itself with an automatic probe. Any deviations are automatically compensated.

Anca from Melbourne (Australia) has developed its Toolroom RN35 software in order to reduce cycle times and thereby improve the productivity of the grinding process as well as reduce ongoing machine costs. This program optimizes the process in terms of tool quality and grinding wheel life. It uses tool simulation models to calculate and reduce gap dimensions in order to minimize air grinding times.

C.O.R.E technology (Customer Oriented Revolution) is an innovative operating system that United Grinding Group has developed for its machines and is presenting for the first time in the German-speaking countries at GrindingHub. The uniform software architecture enables the machines to exchange data without difficulty. Thanks to the built-in umati interface, it also works with third-party systems. Furthermore, the operating system provides access to United Grinding Digital Solutions products without the need to install any additional hardware. Not least, C.O.R.E provides the technical basis for connecting to the IIoT, for different data applications and for uniform operation. Based on self-explanatory icons, navigation through the machine menu and the process steps is simple and fast. The user is offered a modern and clear multi-touch display with very few keys. The entire user interface can be configured freely and individually. Configurations can be automatically retrieved via an RFID chip. Further advantages such as the uniform user interface shorten the amount of training required. A role-specific interface also helps avoid errors and increases programming efficiency. An integrated front camera and Bluetooth headset enable the fast and direct exchange of real-time information.

The new Multigrind Horizon grinding software from Haas can be implemented within a company's own network and run intuitively on tablets, laptops or smartphones. Parameterization, templates and ERP information are used to create the data basis. The programming is simple and allows rapid production changeovers. Enhanced performance, rapid service, regular updates, physical information, safety instructions, process parameters and more can be retrieved from the cloud, as required. Multimation takes care of all these software-based solutions. This software has been specially developed by Haas to match manual and automatic workflows precisely to customer requirements without any loss of process time. The interface to the customer's own network makes it possible to map and control the entire manufacturing process. Process components such as manual scanners, automation solutions, cleaning systems or labeling machines etc. can be added and removed digitally, as desired. In the event of a malfunction, users can use Multimation to bypass individual process components and then regain control again once the fault has been rectified. This in turn allows the downtime to be kept to a minimum.

#### **High degree of automation shortening throughput times**

Another trend which was evident in the manufacturing sector even before Industry 4.0 is cost savings made possible by a high degree of automation. The three key aspects discussed below represent best practices.

The Australian manufacturer Anca demonstrated its Integrated Manufacturing System (AIMS) on its stand. This takes cutting tool production to a new level by optimizing manufacturing and networking. AIMS ensures continuous lights-out manufacturing that can significantly reduce unproductive downtime. This is achieved by means of an automatic workpiece transport system between machines and measuring systems as well as by automated post-measurement compensation of the machine. This permits plant-wide connectivity.

United Grinding Group presented the new uniLoad system for loading the two Studer S31 and S33 universal external cylindrical grinding machines. It is very simple to operate, as the user merely needs to know the dimensions and weight of the workpiece. No special training is therefore

required for operation and programming. With the racks fully loaded, automated processing for about one hour is possible.

Rollomatic has also introduced a new system in the ever-topical field of lights-out manufacturing. The Swiss company presented its new Smart Factory concept, including various types of robots, on its stand. Rollomatic's goals here are to produce within tight tolerances over a number of days and to interact with external robotic and automation systems.

### **Precise measurement technology – a core aspect at GrindingHub**

In order to meet the ever more exacting tolerances, the demands on the measurement technology used for acquiring data are also increasing. Laser measuring systems and automated quality control were also on display at GrindingHub.

Another recently launched development for the cutting tool industry is Anca's LaserUltra (LC50-DIGILOG) measuring system. LaserUltra is an automatic external profile measurement and compensation system for Anca's FX, TX and MX machines. It can achieve accuracy levels down to 2 µm in self-controlled production grinding – ideal for measuring and compensating tools in order to maintain fine tolerances. A special feature here is that the laser is an in-process measuring technology that does not require the tools to be removed from the machine.

In addition, Anca has presented its new CPX in-process AD quality control measurement system. It can monitor and control the outside diameter of ground blanks during batch production. The measuring system is used to calculate, control and monitor the Cp and CpK process capability values and report them to the user via a statistical process control (SPC).

E. Zoller GmbH & Co. KG from Pleidelsheim was in Stuttgart to exhibit its automation solutions and innovative measuring machine devices. The family-owned technology company's roboSet 2 is a fully automatic tool measuring system that independently carries out the complete sequence, including everything from the chucking process to logging. The Genius is a versatile universal measuring machine that can be functionally adapted depending on the type of add-on. The



variations here range from the measurement of geometries on cutting edge and threading tools through to the automatic detection of tool breakage on each cutting edge. The high-precision inspection application  $\mu$ Focus delivers exact cutting-edge analysis results. This innovative instrument measures both the cutting-edge preparation and the surface roughness of the tools down to the nearest micrometer. Zoller offers its TMS Tool Management Solutions for intelligent tool management. The storage system optimizes the work process, as all data and current conditions are stored in the database and can easily be retrieved at any time.

### **Secondary machining processes: High-precision clamping technology and reduced cooling lubricant consumption**

The clamping technology specialist Schunk from Lauffen am Neckar presented its new clamping device concept for tool grinding at GrindingHub. The Ampilio chuck innovation has been specially developed for 24/7 production. 3D technology and an adapted surface structure make it possible to achieve significantly higher expansion rates compared to conventional expansion technology. A coordinated manufacturing strategy and specially developed intermediate bushings are used to achieve concentricity accuracies down to less than 3  $\mu$ m with direct clamping and a maximum of 5  $\mu$ m with indirect clamping (including intermediate bushing). Another positive aspect is that higher insertion clearances can be accommodated in the automation, which reduces wear on the chuck and thus greatly increases its service life. The chucks are available in a diameter range from 20 to 32 mm.

The automation of machining fluids is still in its infancy. Five years ago, the Motorex-Bucher Group from Switzerland addressed this task and has since built up a product portfolio for both water and oil-based systems. A large proportion of users measure, maintain and fill their machines by hand and enter the values in handwritten lists. Consuming over 25,000 tonnes of coolant per year, more than 200,000 cooling lubricant systems are in operation in Germany alone. The Fluidlynx development is a smart solution that can be used in a whole range of applications. It has given rise to numerous patent applications and manufacturing software solutions that enable automated fluid operation 24 hours a day, 365 days a year. According to Motorex, the solution will help achieve a 15 percent reduction in the consumption of cooling lubricant concentrate. The manufacturer

claims that no more "geometrical changes arise due to lower water temperatures", as the mixing process is completely different to that used in previous applications. There is an increase in overall equipment effectiveness (OEE) due to 100 percent cooling lubricant availability and the long-term accuracy of the fluid limits. Contact eczema and allergies remain the primary cause of absenteeism in the metal industry. This has been responded to by adapting algorithms in the maintenance system to ensure that both the pH value as well as the concentration and conductivity levels always stay within the target range. The Easy Monitoring APP takes care of photometrically controlling the applications and checking the sensors in real time – and correcting them if necessary.

### **Science forging technical links**

The latest exciting research projects were also showcased at GrindingHub. For instance, IGW project 21489 N "Contour-adapted polishing grinding for boring and milling tools" was presented by the Institute of Machining Technology (ISF) of the Technical University of Dortmund in cooperation with the German Machine Tool Builders' Association (VDW).

Another research project was presented by the Institute of Production Engineering and Machine Tools at Leibniz University Hannover. Here, scientists are working on reducing high manufacturing costs in the grinding of milling tools made of polycrystalline cubic boron nitride (PcBN). What is remarkable about this material in grinding operations is that it can extend tool life by a factor of up to 100. Scientific studies identified the best combination of feed rate and tool infeed. The metal removal rate could then be increased in three steps. Implementation of the redesigned process was validated in a 5-axis grinding operation to grind milling cutters. The PcBN tool yielded a significant reduction in wear of  $G > 14$ .

For geopolitical, economic and ecological reasons, Leibniz University Hannover has been investigating the use of flint as a natural rock type. A preliminary study was carried out to identify rock properties for grinding technology applications. Variables which influence the grinding process could then be determined and used to evaluate application and wear behavior. This project was completed by using the rock-based cutting tool to machine aluminum and plastic.

### Focus on the future with start-ups

Rimon Technologies is a spin-off from ETH Zurich. The start-up has developed a code-free platform that allows companies to create instruction-based applications for their employees (from technical specialists to medical staff). This platform makes it possible to reduce the number of errors and to negotiate processes more effectively. All steps are automatically documented in the background. Instead of printing out operating instructions on paper, users can be guided interactively through technically demanding tasks with the support of augmented reality. Another great advantage is that the hands remain free for manual tasks.

AtlasVR AG, also a spin-off of ETH Zurich, is revolutionizing training and education processes with virtual reality (VR). The VR training solutions enable active learning in an intuitive learning-by-doing process. This allows learners to be trained up on the virtual machine tool while the actual machine is still on its way, or cannot yet be made full use of in production. Considerable costs can be saved in this way compared to conventional training on actual machine tools. In addition, virtual training is proven to be more effective and sustainable than traditional training solutions. It is suitable for global use, regardless of the language or location. The company supports its partners at all stages – from the initial contact with VR technology and implementation and roll-out through to service and maintenance during operation.

The start-up Spanflug Technologies GmbH from Rattenkirchen showcased its "Spanflug for Finishers" calculation software at the GrindingHub. This software-as-a-service solution allows users to evaluate the manufacturability of turned and milled parts in just a few seconds in order to quote a price. The Bavarian company celebrated the launch of a new feature in Stuttgart: the software now also automatically calculates grinding cost factors. "Spanflug for Finishers" deploys a pricing algorithm that Spanflug has been using since 2018 on its online platform for the procurement of CNC turned and milled parts. This has since been optimized and now incorporates more than 300,000 turned and milled parts. The calculation software automatically evaluates production-relevant characteristics from CAD models and technical drawings, using them to calculate production times and quotation prices. In addition, the user receives a detailed breakdown of the calculated costs for materials, setup, programming, manufacturing and shipping.

Unveiled at GrindingHub, the latest version of the software also allows users to automatically calculate turned and milled parts including grinding. Spanflug operates a manufacturing platform for CNC turned and milled parts and offers customers a fully automated procurement process which includes everything from instant pricing to ordering in the online store. The CNC components are manufactured by a network of 200 authorized suppliers in Germany.

G-Elements from Wallisellen (Switzerland) has developed an innovative CNC cylindrical grinding machine: the Omnia G-300. This is aimed at users who are looking for a cylindrical grinding machine that takes up little space, achieves high precision levels, meets the highest safety standards, grinds efficiently, is easy to operate and has low service costs. G-Elements states that accuracy levels within tolerances of  $\pm 2 \mu\text{m}$  can easily be achieved with the Omnia G-300. This – and more – is made possible by the new axis concept, which was developed to meet the particular requirements of cylindrical grinding.

ultraTEC Anlagentechnik Münz GmbH from Laupheim presented its A25 ultrasonic deburring system on its stand. Ground hydraulic parts were deburred live on the stand using two different sonotrodes. According to ultraTEC, its highly innovative ultrasonic and cavitation-based deburring systems allow high-precision components, cutting tools and components with control edges to be deburred automatically, leaving them "sharp-edged but burr-free". The component dimensions and the mechanical technological values do not change. Even sensitive surfaces can be carefully deburred using ultrasound. The highly localized deburring of individual edges and bores is possible due to the dedicated process control. Micro parts for the optics or watchmaking industry as well as components weighing up to 20 kg can be reliably machined.

During ultrasonic deburring, a sonotrode excited by an ultrasonic generator oscillates back and forth over a distance of 0.1 mm 20,000 times per second in a process water basin. The burrs can be raised and carefully removed by moving the edges and bores of a component to be deburred along the sonotrode tip at a defined angle with the help of an industrial robot that can be used in round-the-clock operation. The ultrasonic process requires only about 5 percent of the energy needed for ECM or high-pressure waterjet deburring and the process water can readily be disposed of,

giving this process a promising future in terms of resource conservation and environmental protection.

### **The new hub of grinding technology**

The exhibitors at GrindingHub have risen to meet customers' specific wishes and the growing market demands with innovative grinding machines, new tool concepts and precise clamping technology. The claim of the new trade show – "Brings solutions to the surface" – has thus been fulfilled in the best possible way. In the different areas of intelligent interface technology, the companies addressed the overriding subject of Industry 4.0 in the context of digitalization and thus responded successfully to the overall theme of the GrindingHub. Visitors can look forward to marveling at the progress made in these areas – and much more besides – in Stuttgart in two years' time from 14 to 17 May 2024.

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### **Background GrindingHub 2022 in Stuttgart**

The first ever GrindingHub was held in Stuttgart from 17 to 20 May 2022. It is the new trade fair and the new center for grinding technology. It is scheduled to be run every two years by the VDW (German Machine Tool Builders' Association), Frankfurt am Main, in cooperation with Messe Stuttgart and the Schleiftagung, as well as the "Machine Tools" industry sector of Swissmem (Association of the Swiss Mechanical, Electrical and Metal Industries) as institutional patron. Grinding is one of the top 4 manufacturing processes within the machine tool industry in Germany. In 2021, the sector produced machines to the value of 820 million euros, according to official statistics. 84 per cent of these were exported, with about half going to Europe. The largest sales markets are China, the USA and Italy. Internationally, China, Japan and Germany led the world rankings in 2021. According to VDW estimates, the grinding technology sector produced 5.2 billion euros worth of machines in 2021.

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