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DIGITALIZATION OF THE HONING PROCESS: CONTINUOUS TRACEABILITY *WITH RFID!*

Machine and precision tool manufacturer Kadia has already delivered more than 1,000 RFID tagged tools to customers.

Henning Klein,
Managing Director, Kadia

Michael Gumbold,
Control Development, Kadia

HENNING KLEIN
Managing Director
&
MICHAEL GUMBOLD
Control Development, Kadia, in an interview with RFID & Wireless IoT Global

Honing is a mechanical superfinishing process for bores. Maximum precision is required in the honing process. Example: Honed high-pressure bores of a gasoline direct injection pump must not exceed a maximum deviation of plus/minus 0.5 micrometers. Different tools are required for each process stage. A mix-up of tools can have serious consequences for the component and the honing machine. With an RFID-based solution, this danger of confusion is eliminated. Furthermore, the digital management of the tools generates advantages for users and manufacturers. The company Kadia Produktion develops and produces these tools and machines.

Kadia

Kadia Produktion from Nürtingen is a medium-sized company that was founded over 60 years ago. 200 employees are working at three locations in Germany and the USA. Kadia Produktion specializes in high-precision drilling and mechanical deburring.

TOOL ALLOCATION

Mix-Ups Are Impossible!

Bosch, a client of Kadia, uses honing machines that are equipped with up to five different honing spindles. The components are machined in sequential processes. The different spindles cannot be visually distinguished. However, the cutting tools differ significantly from each other. The assignment of the correct tool to the machining program and component is therefore a critical process. To ensure the necessary plausibility check, Kadia integrated an RFID solution. Each tool can be uniquely identified with a transponder. If the inserted tool does not match the machining program or workpiece, the machine will not start. "The bidirectional communication between spindle and machine makes RFID the only possible technology," explains Henning Klein.

Up to 1 Million Honing Cycles per Tool

Kadia has already delivered more than 1,000 RFID tagged honing tools. Companies like Bosch use between 300 and 500 tools in the cycle of a machining project. The number of honing tools used depends on the number of pieces to be produced and the number of available machines. The average operating time, defined as service life, is 20 to 50,000 parts per tool. At the end of the service life, the honing tools are returned to Kadia for reconditioning. At least ten reconditionings are possible per tool. "Up to one million machined parts with one continuously reconditioned tool is not unusual," reports Michael Gumbold.

12-Month Development Phase

A client of Kadia was looking for a way to capture identification and process data on honing tools. Kadia's engineers responded to these customer requirements by programming a digital tool management system. The proof of concept covered a total of three areas: Definition of the data to be stored, integration of the hardware in the tools and machines, and development of a database for use at Kadia with the prospect of a customer solution. The entire development process from the initial idea to the market-ready solution took about a year. "The goal was very clear. The product should be mature from the very beginning. A rush job would have meant additional rework. We also had to find the best compromise in terms of the data to be stored on the transponders. Our numerous ideas for this would not have fit in any transponder memory," explains Michael Gumbold.

Preventing Forgeries and Reclamation

In addition to the operational benefits of using the tools and recycling, Kadia is pursuing other objectives with the RFID-based solution. "If we can integrate this cycle flawlessly, and if this solution works with the tags, we will then be able to have a customer relationship with the company. This gives us an advantage over other closed systems," says Henning Klein. A second, strategic aspect is the prevention of plagiarism, or the prevention of machine damage caused by non-original additional parts. The RFID-based documentation creates transparency regarding use and automatically prevents reclamation of parts that are not originally from Kadia. An encryption of the data on the transponders is not (yet) realized at the moment, but, according to Michael Gumbold, "a checksum calculation is a simple and effective way to check data consistency.

All data on service life, geometry and expansion reasons are stored in a fluid memory on the Neosid HF RFID transponders. The memory is overwritten every five cycles. As a result, a continuous comparison with the database is carried out. For the future, there are plans to provide customers with tools for visualizing and using the recorded data.

"Bringing RFID technology in miniaturized and highly robust form directly into the tools is a decisive advantage in the process. This applies to the entire life cycle of the tool. We gain insights into usage and requirements that we would not have achieved without this technology. This is a realized Industry 4.0 in a high-tech environment."

Henning Klein,
Managing Director,
Kadia

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In the honing process, mineral oil-based cooling lubricants (KSS) are permanently supplied for cooling and rinsing. The materials used, such as the housings of the pressed-in RFID transponders, have to withstand the chemically active substances even after one million honing cycles.

TECHNOLOGY

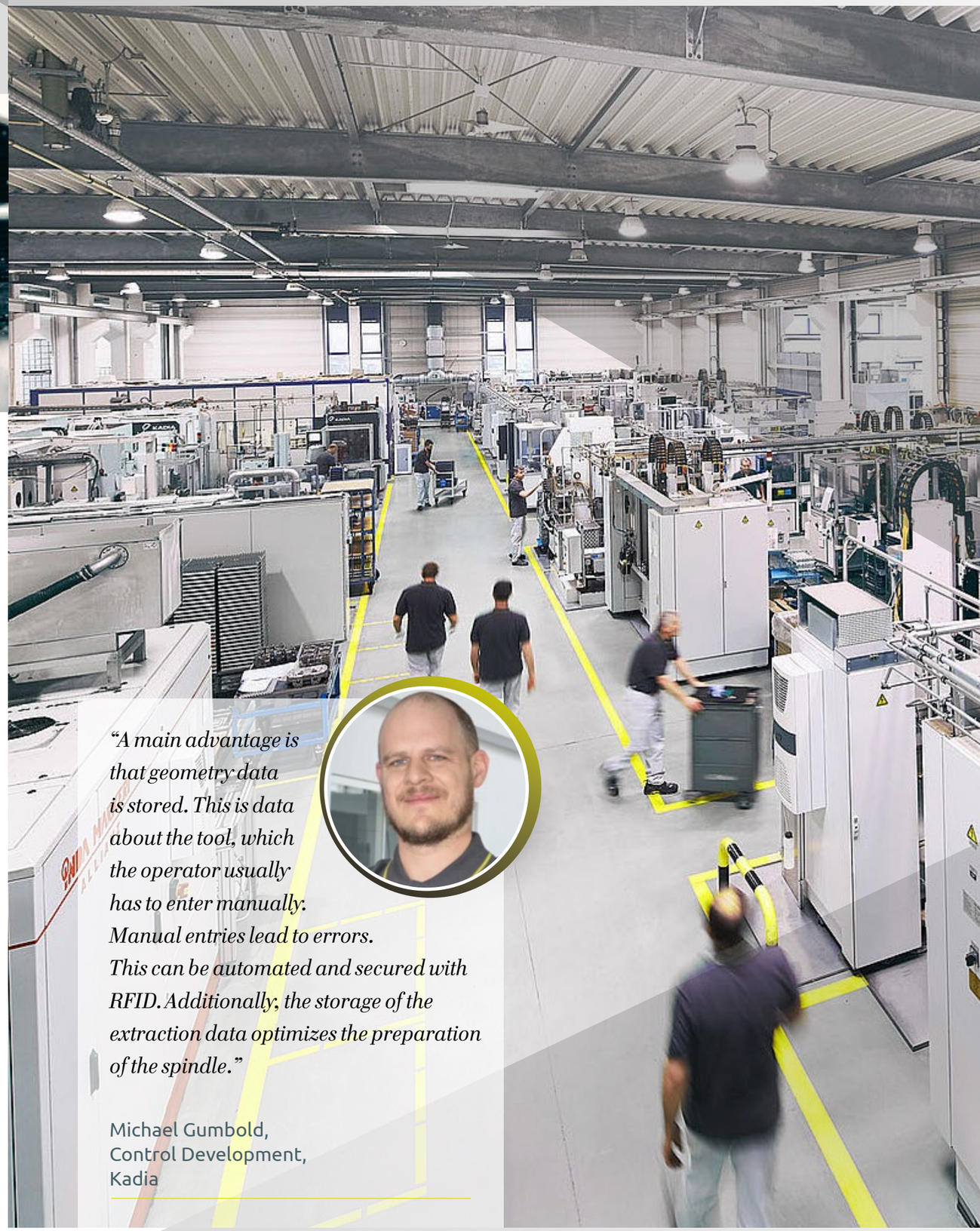
Miniaturized HF Tags in the Spindle

The central interface in Kadia's solution are the HF RFID transponders from Neosid in the honing tools. The largest diameter of the spindles measures just 20 millimeters. The transponders must be installed flush-mounted in order not to damage the machine including the read/write head during rotation. The limited space available made a transponder with an equally small installation depth and narrow diameter necessary. After numerous test runs, the Neosid Neotag Plug MFG4335 was defined as a suitable solution. A drill hole with a diameter of four millimeters and a depth of 3.7 millimeters is sufficient to press in the transponder together with the housing made of high-performance thermoplastic. Together with Neosid, the suitable read/write head was selected, which is integrated into the honing machine at a distance of only a few millimeters from the rotating spindle. A connection to the HMI of the respective machine is ensured via bus communication.

DIGITIZATION

'Manual' and 'Time-Consuming' are Things of the Past

The fact that Kadia's solution is suitable to enable M2M communication is currently being demonstrated at a company in Switzerland. Two honing machines are in parallel operation. The customer's requirement: to exchange a tool, including all parameters and information, between the machines so that components are produced 100 percent accurately by both machines. "In this way, the machines receive complete information on the tool used in each case and can make the parameter settings accordingly. In bore machining operations where deviations of 0.5 micrometers are crucial for the quality of the component, exact information is an absolute success factor. A perfect implementation of the Industry 4.0 guiding principle of digital support of exactly reproducible manufacturing steps," concludes Henning Klein.



"A main advantage is that geometry data is stored. This is data about the tool, which the operator usually has to enter manually. Manual entries lead to errors. This can be automated and secured with RFID. Additionally, the storage of the extraction data optimizes the preparation of the spindle."

Michael Gumbold,
Control Development,
Kadia

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Miniaturized RFID/NFC transponders for tough, industrial applications: In metal, in contact with aggressive liquids, at temperatures up to 275°C.

MATTHIAS HÖSS

Head of Development at Neosid, in a conversation with *RFID & Wireless IoT Global*

MINI-RFID TRANSPONDER:

Can it be Even Smaller?

Industrial production is a harsh environment. Massive forces are exerted on tools and workpieces. Aggressive cleaning, grinding and cooling agents damage unsuitable materials. High temperatures affect all components. How can RFID/ NFC transponders measuring only a few millimeters in size permanently survive in such an environment? Neosid Development Manager Matthias Höß explains how the bridge can be built between extreme conditions and miniaturized transponders. This is not only possible under storage conditions: Transponders that are just 2.6 millimeters in diameter are used in industrial environments under the toughest conditions. In a conversation with *RFID & Wireless IoT Global*, Matthias Höß gives an outlook on the current industry trend towards NFC and the continuous development of high-performance, ultra-small transponders.

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With the NeoTAG® Flag, Neosid has created a solution to tag even objects which are too small for drilling a hole or the use of glued-on industrial Labels.

"The ferrite know-how Neosid has built up over decades plays a decisive role in making the transponders small and stable. The special design enables the transponders to be pressed or driven into bores in metallic objects such as tools."

Matthias Höß
Head of Development
Neosid

Pressed or Fastened

How does Neosid manage the balancing act between highest robustness and smallest design? "The ferrite know-how Neosid has built up over decades plays a decisive role in making transponders small and stable," emphasizes Matthias Höß. The Neosid transponders – Neotags – are supplied as a plug with a housing made of high performance thermoplastic that has been selected to meet the requirements regarding mounting and durability. A ferrite-based inlay is inserted into the housing with diameters of 4, 8 and 10 millimeters. "This design allows the transponders to be pressed or driven into bores in metallic objects such as tools". In the course of the insertion, the outer casing jams with the inner wall of the borehole. This results in a robust fastening in the borehole. The transponder is flush-mounted and protected against mechanical influences.

Nailing One's Colours to the Mast

"Another type of design is the flag transponder series. We use the same plastics and inlays for production as for the press-fit versions. However, the Flags are attached to objects with cable ties." With the NeoTAG® Flag, Neosid has created a solution to provide objects where drilling or gluing is not possible with a robust and smart marking. "The flags are ideal for marking cables, hoses or slings, for example," says Höß. Cable ties up to a width of 4.8 millimeters can be used. Other fasteners, such as round wires and stranded wires, can alternatively be used together with the NeoTAG® Flag to tag metallic and non-metallic objects.

A Look at the Development Roadmap: It Will Get Even Smaller!

The Neosid development team is currently working on further miniaturization of the NeoTAG® transponders: "We are able to reduce the press-in depth to just under 2.6 millimeters and realize a diameter of three millimeters," says Matthias Höß, providing an insight. The fact that the already very small tags can take a further step towards miniaturization is also due to the targeted further development of the process technology. "When Neosid presented the very first NeoTAG® about eight years ago, it was at the limit of what was possible in terms of size with the process technology of 2012. The development of the manufacturing possibilities has advanced considerably, especially in the past five years. In 2020 we will be in a position to

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offer the NeoTAG® concept – smallest dimensions and highest performance also in metal – for even more applications," emphasizes Höß.

NFC Increasingly in Demand

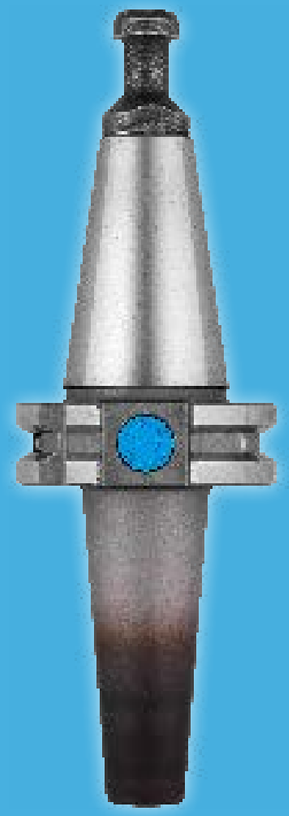
Tough industrial environments and fragile smartphones – how does that fit together? Is NFC even required in industrial processes? "A legitimate question," confirms Höß, providing some insight: "In the context of IoT and Industry 4.0, more and more companies are looking for solutions that allow employees to capture information from tools, machines or components quickly and easily without the need for special hardware. From tool management or from maintenance and servicing processes we are receiving increasing demand for NFC-compatible solutions." Numerous transponders in the Neosid portfolio are already NFC-enabled, "the NFC readability of the transponders is continuously being expanded. Almost the entire portfolio of HF tags can already be read with an NFC-enabled terminal device today." The minimal size of the Neosid transponders requires point reading when inserted into metallic objects. "We also support manufacturers of industrial readers with our antenna know-how," says Höß.

Application Example: Tool Management

If tools are labeled with a NeoTAG®, this opens up numerous options for tool manufacturers and users. The digital recording and further processing of operating data such as tool life saves time and money, creates transparency, reduces sources of error and optimizes resource planning. "A 10-millimeter borehole is already available as default in numerous tool holders. The press-fit housing of the NeoTAG® Plug MFG10340 is precisely matched to this borehole and can therefore be mounted securely and quickly. Following the guiding principle of Industry 4.0, smart tools are created in just a few steps that can be read with common mobile devices. Transparent and digital processes in industrial applications become a reality."

Application Example: Maintenance

Chains and slings in industry and logistics are exposed to high mechanical stress. They are therefore subject to strict requirements for regular maintenance and inspection. Optical labeling or externally applied transponders are mechanically unacceptable. "The NeoTAG® transponders create the decisive advantage here. They are integrated into the components in a well protected manner. The low space requirement ensures that the stability of slinging and lashing equipment is not affected," says Höß. The result: inspectors save time. Errors are eliminated. All chains and attachment points can be digitally managed. All tests are documented in a legally compliant manner.



Numerous transponders in the Neosid portfolio are already NFC-enabled, e.g. for reading from a tool holder using a smartphone.

Miniaturizationis the Key to Integration

How do the minimal dimensions make NeoTAG® transponders the ideal identification solution in terms of IoT? "This small size puts the question into perspective whether objects can be labeled with RFID at all," says Höß, adding: "This applies not only to tools and lashing equipment, but also to medical instruments, for example. The objective here: Every single pair of scissors, every single reusable scalpel should be permanently identifiable. "Robustness is the decisive aspect in healthcare. The NeoTAG® transponders survive countless sterilization and reconditioning processes. High temperatures, pressures or chemicals do not affect the tags," Höß explains.

Made in Germany and 100 Percent Quality-Tested

The NeoTAG® transponders are manufactured in Germany in a fully automated transponder production facility at the company's headquarters in Halver. 'Made in Germany' is an important aspect – this also includes the fact that all transponders are subjected to multiple tests in order to meet the highest quality requirements," emphasises Höß.

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