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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

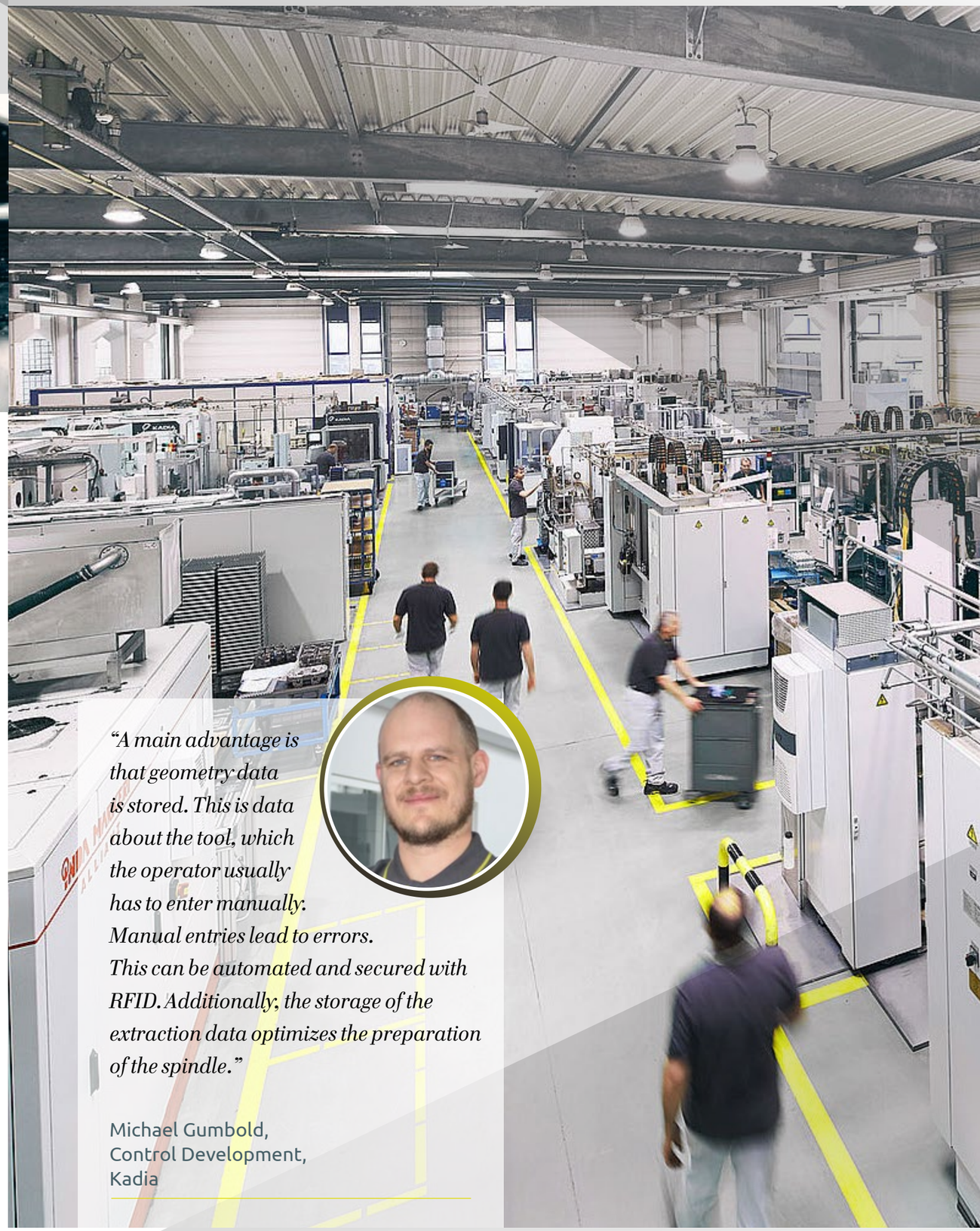
Miniaturized HF Tags in the Spindle

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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